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September 28, 1979

THE ESTUARINE STUDY

VOLUME 4

DOCUMENTATION

Prepared for: New Jersey Department of Environmental Protection
Division of Coastal Resources
Bureau of Coastal Planning and Development
Labor and Industry Building
PO Box 1889
Trenton New Jersey 08625

Contract A97146

This report was prepared in part with financial assistance from the United States Department of Commerce National Oceanic and Atmospheric Administration Office of Coastal Zone Management under the provisions of Section 305 of the Coastal Zone Management Act of 1972 (Public Law 92-583, as amended).

AIR SOLID WASTE WATER

CONTENTS

Part one of this volume presents a bibliography of over 2,000 references used in this study. Part two presents a documentation method and a large number of references which are keyed to the matriced intersections of water, edge, and land impacting activities and their resultant environmental changes. These impacting activities and environmental changes are discussed in Volumes One and Three. The documentation for these matriced intersections is intended to be constantly updated by the Bureau of Coastal Planning and Development. The use of the documentation matrices is discussed on page107.

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PART TWO: DOCUMENTATION MATRICES

INTRODUCTION

The following matrices and text are intended as an aid in identifying important impact relationships and in referencing them. The primary changes in the land, edge, and water environments which result from the major impacting activities occurring there, are matriced on pages108,109, and110. These matrices are coded with a number for each impacting activity and letter(s) for each environmental change. Therefore when a specific impacting activity causes an environmental change, as indicated by a dot on a matrix, the intersection is coded. The use of this intersection coding system is shown by the following example.

The point indicating that channelization causes decreased faunal abundance on the land matrix is coded 24-AA. This point is referenced on page 147 in Table 3 by the annotated reference numbers 95, 418, and 432. The causal relationship between the impacting activity and the environmental change is then briefly discussed in the Annotated Literature Citation section arranged by citation numbers on pages151-186 . If specific references are desired for this point these are found in the Literature Cited section arranged alphabetically by the author (as given in the Literature Cited section) pages 187 - 209.

In cases where references were not found to document a given point on a matrix, ND (not documented) was placed in the Annotated Literature Cited section to indicate this.

Some of the references used in documenting points on a matrix may discuss the impact relationship in another type but in such a manner that it also applies to the type where used. For example; liquid waste disposal of heavy metals in the edge increases toxic substances in the edge. A reference discussing this relationship for the edge might also be used for the land because the relationship is very similar there.

DOCUMENTATION MATRIX

TYPE: WATER

PRIMARY ENVIRONMENTAL CHANGES		IMPACTING ACTIVITIES	1 COMPACTION	2 WOODY CLEARING	3 HERBACEOUS CLEARING	4 PLOWING/DISCING	5 DIKING	6 FILLING UNCONSOLIDATED	7 FILLING CONSOLIDATED	8 EXCAVATING	9 IMPERVIOUS SURFACE	10 DREDGING	11 FERTILIZING	12 INSECTICIDING	13 HERBICIDING	14 IRRIGATING	15 STRUCTURAL SUPPORT	16 VEHICULAR TRAFFIC	17 WATER TRANSFER/DIVERSION	18 INUNDATION	19 LANDSCAPE/ROW MANAGEMENT	20 DRAINAGE	21 SURFACE WATER DEMAND	22 SUBSURFACE WATER DEMAND	23 CULVERTING	24 CHANNELIZATION	25 PEDESTRIAN TRAFFIC	LIQUID WASTE DISPOSAL: 26 PESTICIDES	27 HEAVY METALS	28 NUTRIENTS	29 THERMAL EFFLUENTS	SOLID WASTE DISPOSAL: 30 ORGANIC	31 HAZARDOUS	32 UNCONSOLIDATED NONHAZARDOUS	33 CONSOLIDATED NONHAZARDOUS	AIR WASTE DISPOSAL: 34 PARTICULATED	35 GASES	36 HAZARDS
AQUIFER RECHARGE	A	I																	●																			
AQUIFER RECHARGE	B	D																	●							●												
GROUNDWATER DISCHARGE	C	I										●							●					●														
GROUNDWATER DISCHARGE	D	D																	●							●												
GROUNDWATER SALINITY	E	I																																				
SURFACE WATER SALINITY	F	I																					●			●												
SURFACE WATER SALINITY	G	D																																				●
WATER TEMPERATURE	H	I																													●							●
WATER TEMPERATURE	I	D																													●							●
SUSPENDED SOLIDS	J	I						●	●			●					●					●			●	●				●		●	●	●	●	●		
SUSPENDED SOLIDS	K	D																																				
TOXIC SUBSTANCES	L	I						●	●			●		●	●		●					●						●	●	●		●	●			●	●	●
NUTRIENTS	M	I						●	●			●					●					●			●	●				●			●	●	●	●	●	●
NUTRIENTS	N	D																																				
PATHOGENS	O	I						●	●			●										●										●	●	●		●		●
pH	P	I						●				●										●										●	●	●		●	●	●
pH	Q	D						●				●										●										●	●	●		●	●	●
DISSOLVED OXYGEN	R	D						●				●										●								●	●	●	●	●	●			●
DISSOLVED SOLIDS	S	I						●	●			●					●					●	●			●						●	●	●	●	●		●
DISSOLVED SOLIDS	T	D																																				
SUBSTRATE PARTICLE SIZE	U	I							●																										●			
SUBSTRATE PARTICLE SIZE	V	D						●																										●				
SEDIMENTATION	W	I																																				
SEDIMENTATION	X	D																																				
SEDIMENT CHEMISTRY	Y							●	●			●																●	●	●	●	●	●	●	●			●
FAUNAL ABUNDANCE	Z	I							●								●																		●			
FAUNAL ABUNDANCE	AA	D						●	●			●					●		●				●		●	●								●	●			
FAUNAL REPRODUCTIVE POTENTIAL	BB	I							●								●																		●			
FAUNAL REPRODUCTIVE POTENTIAL	CC	D						●	●			●							●				●			●								●	●			
FAUNAL DIVERSITY	DD	I							●								●																		●			
FAUNAL DIVERSITY	EE	D						●	●			●							●				●		●	●								●	●			
FLORAL ABUNDANCE	FF	I						●																										●				
FLORAL ABUNDANCE	GG	D						●	●			●					●		●						●	●								●	●			
FLORAL DIVERSITY	HH	I						●																														
FLORAL DIVERSITY	II	D						●	●			●							●						●	●								●	●			
SUNLIGHT PENETRATION	JJ	D										●					●								●													
PRIMARY PRODUCTIVITY	KK	I						●																										●				
PRIMARY PRODUCTIVITY	LL	D						●	●			●					●		●						●	●								●	●			
SOIL ASSIMILATIVE CAPACITY	MM	I																																				
SOIL ASSIMILATIVE CAPACITY	NN	D																																				
BATHYMETRY VARIABILITY	OO	I						●	●			●					●																	●	●			
WATER DEPTH	PP	I										●							●							●												●
WATER DEPTH	QQ	D						●	●										●				●			●								●	●			●
SHORE PROTECTION CAPACITY	RR	I						●	●								●		●																			
SHORE PROTECTION CAPACITY	SS	D										●							●																			
SHORELINE CHANGES	TT							●	●										●							●								●	●			
LITTORAL DRIFT	UU	I						●																										●				
LITTORAL DRIFT	VV	D							●			●					●																		●			
RUNOFF	WW	I																																				
EROSION/SCOURING	XX	I										●						●																				
EROSION/SCOURING	YY	D																																				
FLOOD FREQUENCY	ZZ	I						●	●																													
FLOOD FREQUENCY	AAA	D																	●																			
FLOOD INTENSITY	BBB	I						●	●																													●
FLOOD INTENSITY	CCC	D																	●																			
FLOW REGIME	DDD							●	●			●					●		●				●	●		●		●	●	●	●	●		●	●			●
CIRCULATION/MIXING	EEE	I						●	●			●					●	●	●						●	●					●							●
CIRCULATION MIXING	FFF	D						●	●			●					●		●												●							
NOISE	GGG																	●																				

I = Increase

D = Decrease

DOCUMENTATION MATRIX

TYPE: EDGE

IMPACTING ACTIVITIES

LIQUID WASTE DISPOSAL · SOLID WASTE DISPOSAL · AIR WASTE DISPOSAL

PRIMARY ENVIRONMENTAL CHANGES			1 COMPACTION	2 WOODY CLEARING	3 HERBACEOUS CLEARING	4 PLOWING/DISCING	5 DIKING	6 FILLING UNCONSOLIDATED	7 FILLING CONSOLIDATED	8 EXCAVATING	9 IMPERVIOUS SURFACE	10 DREDGING	11 FERTILIZING	12 INSECTICIDING	13 HERBICIDING	14 IRRIGATING	15 STRUCTURAL SUPPORT	16 VEHICULAR TRAFFIC	17 WATER TRANSFER/DIVERSION	18 INUNDATION	19 LANDSCAPE/ROW MANAGEMENT	20 DRAINAGE	21 SURFACE WATER DEMAND	22 SUBSURFACE WATER DEMAND	23 CULVERTING	24 CHANNELIZATION	25 PEDESTRIAN TRAFFIC	26 PESTICIDES	27 HEAVY METALS	28 NUTRIENTS	29 THERMAL EFFLUENTS	30 ORGANIC	31 HAZARDOUS	32 UNCONSOLIDATED NONHAZARDOUS	33 CONSOLIDATED NONHAZARDOUS	34 PARTICULATE	35 GASES	36 HAZARDOUS
AQUIFER RECHARGE	A	I					●			●		●				●			●	●				●				●	●	●	●	●						
AQUIFER RECHARGE	B	D	●	●	●			●	●		●						●		●			●	●		●	●								●	●			●
GROUNDWATER DISCHARGE	C	I								●		●							●			●	●	●		●												●
GROUNDWATER DISCHARGE	D	D					●	●			●									●																		
GROUNDWATER SALINITY	E	I																																				
SURFACE WATER SALINITY	F	I																																				
SURFACE WATER SALINITY	G	D																																				
WATER TEMPERATURE	H	I																																				
WATER TEMPERATURE	I	D																																				
SUSPENDED SOLIDS	J	I																																				
SUSPENDED SOLIDS	K	D																																				
TOXIC SUBSTANCES	L	I						●	●	●		●		●	●			●		●								●	●	●		●	●			●	●	●
NUTRIENTS	M	I						●	●	●		●	●																	●			●	●	●	●	●	●
NUTRIENTS	N	D	●				●	●	●	●	●	●					●		●							●							●	●	●			
PATHOGENS	O	I						●				●																				●	●			●		●
PH	P	I																																				
PH	Q	D																																				
DISSOLVED OXYGEN	R	D																																				
DISSOLVED SOLIDS	S	I																																				
DISSOLVED SOLIDS	T	D																																				
SUBSTRATE PARTICLE SIZE	U	I						●	●	●		●																						●	●			
SUBSTRATE PARTICLE SIZE	V	D						●		●		●																						●				
SEDIMENTATION	W	I															●																					
SEDIMENTATION	X	D		●	●		●																															
SEDIMENT CHEMISTRY	Y		●	●	●			●	●	●	●	●				●			●	●		●											●	●	●			
FAUNAL ABUNDANCE	Z	I							●								●		●	●	●													●			
FAUNAL ABUNDANCE	AA	D	●	●	●		●	●	●	●	●	●				●	●	●	●	●	●	●			●	●	●				●			●	●			
FAUNAL REPRODUCTIVE POTENTIAL	BB	I							●								●		●	●														●			
FAUNAL REPRODUCTIVE POTENTIAL	CC	D	●	●	●		●	●	●	●	●	●				●	●	●	●	●		●			●	●	●				●			●	●			
FAUNAL DIVERSITY	DD	I							●								●		●	●	●													●			
FAUNAL DIVERSITY	EE	D	●	●	●		●	●	●	●	●	●				●	●	●	●	●		●			●	●	●				●			●	●			
FLORAL ABUNDANCE	FF	I					●	●								●			●	●	●										●			●				
FLORAL ABUNDANCE	GG	D	●	●	●		●	●	●	●	●	●					●	●	●	●	●	●			●	●	●				●			●	●			
FLORAL DIVERSITY	HH	I					●	●											●	●	●										●			●				
FLORAL DIVERSITY	II	D	●	●	●		●	●	●	●	●	●				●	●	●	●	●		●			●	●	●				●			●	●			
SUNLIGHT PENETRATION	JJ	D																																				
PRIMARY PRODUCTIVITY	KK	I					●	●								●			●	●	●										●			●				
PRIMARY PRODUCTIVITY	LL	D	●	●	●		●	●	●	●	●	●				●	●	●	●	●	●	●			●	●	●				●			●	●			
SOIL ASSIMILATIVE CAPACITY	MM	I																																				
SOIL ASSIMILATIVE CAPACITY	NN	D	●				●	●	●	●	●	●				●	●		●	●	●	●					●							●	●	●		●
BATHYMETRY VARIABILITY	OO	I																																				
WATER DEPTH	PP	I																																				
WATER DEPTH	QQ	D																																				
SHORE PROTECTION CAPACITY	RR	I					●	●	●		●						●		●								●							●	●			
SHORE PROTECTION CAPACITY	SS	D						●	●	●	●	●					●		●	●																		
SHORELINE CHANGES	TT						●	●	●	●	●	●					●		●															●	●			
LITTORAL DRIFT	UU	I						●											●															●				
LITTORAL DRIFT	VV	D					●	●	●	●	●	●					●		●															●	●			
RUNOFF	WW	I	●	●	●			●	●	●	●								●			●												●	●			
EROSION/SCOURING	XX	I		●	●				●	●	●	●				●	●	●	●	●	●	●														●	●	
EROSION/SCOURING	YY	D					●	●	●		●						●		●								●							●	●			
FLOOD FREQUENCY	ZZ	I								●		●								●																		●
FLOOD FREQUENCY	AAA	D					●	●	●								●																	●	●			
FLOOD INTENSITY	BBB	I					●			●		●								●																		●
FLOOD INTENSITY	CCC	D					●	●	●								●																	●	●			
FLOW REGIME	DDD						●	●	●	●	●	●				●	●		●	●		●	●	●	●	●		●	●	●	●	●		●	●			●
CIRCULATION/MIXING	EEE	I																																				
CIRCULATION MIXING	FFF	D																																				
NOISE	GGG																	●																				

I = Increase
D = Decrease

DOCUMENTATION MATRIX

TYPE: LAND

																											LIQUID WASTE DISPOSAL				SOLID WASTE DISPOSAL				AIR WASTE DISPOSAL		
PRIMARY ENVIRONMENTAL CHANGES		IMPACTING ACTIVITIES	1 COMPACTION	2 WOODY CLEARING	3 HERBACEOUS CLEARING	4 PLOWING/DISCING	5 DIKING	6 FILLING UNCONSOLIDATED	7 FILLING CONSOLIDATED	8 EXCAVATING	9 IMPERVIOUS SURFACE	10 DREDGING	11 FERTILIZING	12 INSECTICIDING	13 HERBICIDING	14 IRRIGATING	15 STRUCTURAL SUPPORT	16 VEHICULAR TRAFFIC	17 WATER TRANSFER/DIVERSION	18 INUNDATION	19 LANDSCAPE/ROW MANAGEMENT	20 DRAINAGE	21 SURFACE WATER DEMAND	22 SUBSURFACE WATER DEMAND	23 CULVERTING	24 CHANNELIZATION	25 PEDESTRIAN TRAFFIC	26 PESTICIDES	27 HEAVY METALS	28 NUTRIENTS	29 THERMAL EFFLUENTS	30 ORGANIC	31 HAZARDOUS	32 UNCONSOLIDATED NONHAZARDOUS	33 CONSOLIDATED NONHAZARDOUS	34 PARTICULATED	35 GASES	36 HAZARDS
AQUIFER RECHARGE	A	I				●	●			●						●			●	●								●	●	●	●	●						
AQUIFER RECHARGE	B	D	●	●	●			●	●		●								●			●	●		●	●								●	●			●
GROUNDWATER DISCHARGE	C	I								●									●				●	●		●												●
GROUNDWATER DISCHARGE	D	D																	●																			
GROUNDWATER SALINITY	E	I																																				
SURFACE WATER SALINITY	F	I																																				
SURFACE WATER SALINITY	G	D																																				
WATER TEMPERATURE	H	I																																				
WATER TEMPERATURE	I	D																																				
SUSPENDED SOLIDS	J	I																																				
SUSPENDED SOLIDS	K	D																																				
TOXIC SUBSTANCES	L	I						●	●					●	●			●										●	●	●		●	●			●	●	●
NUTRIENTS	M	I						●	●				●					●												●			●	●	●	●	●	●
NUTRIENTS	N	D						●	●	●	●											●												●	●			
PATHOGENS	O	I						●																								●	●			●		●
pH	P	I																																				
pH	Q	D																																				
DISSOLVED OXYGEN	R	D																																				
DISSOLVED SOLIDS	S	I																																				
DISSOLVED SOLIDS	T	D																																				
SUBSTRATE PARTICLE SIZE	U	I																																				
SUBSTRATE PARTICLE SIZE	V	D																																				
SEDIMENTATION	W	I																																				
SEDIMENTATION	X	D																																				
SEDIMENT CHEMISTRY	Y																																					
FAUNAL ABUNDANCE	Z	I																				●																
FAUNAL ABUNDANCE	AA	D	●	●	●	●	●	●	●	●	●						●	●		●					●	●	●							●	●			
FAUNAL REPRODUCTIVE POTENTIAL	BB	I																				●																
FAUNAL REPRODUCTIVE POTENTIAL	CC	D	●	●	●	●	●	●	●	●	●						●			●							●							●	●			
FAUNAL DIVERSITY	DD	I																				●																
FAUNAL DIVERSITY	EE	D	●	●	●	●	●	●	●	●	●						●			●							●							●	●			
FLORAL ABUNDANCE	FF	I		●	●	●		●								●					●	●									●			●				
FLORAL ABUNDANCE	GG	D	●	●	●	●	●	●	●	●	●						●			●	●	●			●	●	●				●			●	●			
FLORAL DIVERSITY	HH	I		●	●			●								●					●	●									●			●				
FLORAL DIVERSITY	II	D	●	●	●	●	●	●	●	●	●						●			●	●	●					●				●			●	●			
SUNLIGHT PENETRATION	JJ	D																																				
PRIMARY PRODUCTIVITY	KK	I		●	●	●		●								●					●	●									●			●				
PRIMARY PRODUCTIVITY	LL	D	●	●	●	●	●	●	●	●	●						●			●	●	●			●	●	●				●			●	●			
SOIL ASSIMILATIVE CAPACITY	MM	I				●		●																										●				
SOIL ASSIMILATIVE CAPACITY	NN	D	●				●	●	●	●	●									●							●							●	●	●		●
BATHYMETRY VARIABILITY	OO	I																																				
WATER DEPTH	PP	I																																				
WATER DEPTH	QQ	D																																				
SHORE PROTECTION CAPACITY	RR	I																																				
SHORE PROTECTION CAPACITY	SS	D																																				
SHORELINE CHANGES	TT																																					
LITTORAL DRIFT	UU	I																																				
LITTORAL DRIFT	VV	D																																				
RUNOFF	WW	I	●	●	●			●	●		●										●	●												●	●			
EROSION/SCOURING	XX	I		●	●					●										●						●										●	●	
EROSION/SCOURING	YY	D				●	●	●	●		●						●			●						●								●	●			
FLOOD FREQUENCY	ZZ	I																																				●
FLOOD FREQUENCY	AAA	D					●	●	●																													
FLOOD INTENSITY	BBB	I																																				●
FLOOD INTENSITY	CCC	D					●	●	●																													
FLOW REGIME	DDD		●	●	●	●	●	●	●	●	●								●			●	●	●	●	●		●	●	●	●	●		●	●			●
CIRCULATION/MIXING	EEE	I																																				
CIRCULATION/MIXING	FFF	D																																				
NOISE	GGG																	●																				

I = Increase

D = Decrease

Table 1. Annotated Documentation for Water Impacting Activities and their Subsequent Environmental Changes

Impacting Activity #6: Filling-Unconsolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	14, 31, 39, 207, 208, 210, 213, 256
L	7, 12, 13, 15, 20, 30, 81, 203, 211, 280, 348, 349
M	3, 4, 5, 6, 24, 192, 202, 206, 212, 279, 280
O	221
P	212
Q	12
R	13, 19, 20, 21, 40, 41, 42, 43, 83, 204, 205, 212, 279, 280
S	ND
V	267
Y	21, 35
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 187, 192, 193, 202, 209, 214, 279, 280
CC	7, 11, 186, 192, 193
EE	192
FF	5, 8, 10, 24, 31
GG	8, 17, 31, 37, 45
HH	ND
II	37, 45
KK	5, 10, 24, 31, 39, 212
LL	1, 2, 22, 23, 31
OO	21
QQ	28
RR	ND
TT	21
UU	ND
ZZ	ND
BBB	ND
DDD	21, 28
EEE	21, 28
FFF	21, 28

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #7: Filling-Consolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	ND
L	350, 351, 353, 357, 359
M	351, 359
O	ND
S	351, 353
U	ND
Y	ND
Z	321, 322, 323, 366, 374
AA	366
BB	321, 322, 374
CC	ND
DD	321, 322, 374
EE	ND
GG	ND
II	ND
LL	ND
OO	321
QQ	ND
RR	ND
TT	374
VV	374
ZZ	ND
BBB	ND
DDD	ND
EEE	321
FFF	ND

Impacting Activity #10: Dredging

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
C	220
J	14, 29, 31, 39, 207, 208, 210
L	7, 12, 13, 15, 20, 30, 69, 81, 203, 211, 279, 280, 348, 349
M	3, 4, 5, 6, 24, 202, 212, 279, 280
O	221
Q	12
R	13, 19, 20, 21, 40, 41, 42, 83, 204, 205, 212, 279, 280
S	ND

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #10: Dredging (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
Y	35
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 187, 193, 202, 209, 214, 279, 280
CC	7, 11, 186, 193
EE	16, 38
GG	8, 17, 31, 37, 45
II	8
JJ	14, 30, 31, 279, 280
LL	1, 2, 22, 23, 31
OO	38
PP	ND
SS	203
VV	ND
XX	21, 28, 31, 203
DDD	21, 28, 220
EEE	21, 28, 203
FFF	21, 28, 44

Impacting Activity #12: Insecticiding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	175, 176, 215, 216, 217, 218, 313

Impacting Activity #13: Herbiciding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	318, 324, 325, 326, 327, 328

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #15: Structural Support

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	317
L	283, 284, 317
M	285, 320
S	320
Z	321, 322, 323
AA	284, 285, 320
BB	284
DD	321
GG	284, 317, 320
JJ	320
LL	284, 320
OO	298
RR	295, 298
VV	285, 295, 298
DDD	284
EEE	298
FFF	283, 284, 285, 298, 317, 319

Impacting Activity #16: Vehicular Traffic

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
XX	360
EEE	360
GGG	ND

Impacting Activity #17: Water Transfer/Diversion

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
B	ND
C	ND
D	ND

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #17: Water Transfer/Diversion (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	48, 50, 57, 61, 62, 68, 70, 72, 180, 183, 219, 226, 229, 232, 233, 234, 237, 240, 242, 243, 244, 245, 248, 290, 291, 297, 371, 372, 377
CC	50, 54, 55, 56, 58, 59, 60, 63, 64, 70, 72, 181, 199, 219, 227, 230, 239, 241, 331, 333, 373
EE	224, 225, 232
GG	66, 179, 183, 219, 234, 235, 243, 378
II	ND
LL	178, 183, 223, 266, 300, 301, 302
PP	219, 234
QQ	219, 234
RR	219
SS	219
TT	219, 228
AAA	49, 219, 371
CCC	49, 219, 371
DDD	47, 49, 66, 91, 198, 219, 225, 371
EEE	47, 49, 201, 219, 334
FFF	47, 51, 52, 91, 178, 181, 183, 219, 291, 313

Impacting Activity #20: Drainage

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	102, 196, 399
L	196, 399
M	196, 246, 308
O	196, 309, 411
P	ND
Q	ND
R	ND
S	ND

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #21: Surface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
F	53, 50
S	50
AA	50, 56
CC	50, 56, 62, 63, 64
EE	50, 56, 63
QQ	ND
DDD	58

Impacting Activity #22: Subsurface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
C	ND
DDD	ND

Impacting Activity #23: Culverting

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	315
M	315
AA	ND
EE	ND
GG	ND
II	ND
JJ	315
LL	ND
EEE	315

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #24: Channelization

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
D	336, 418
F	187, 188
J	270, 418
M	190
S	187, 188
AA	187, 233, 249, 252, 253, 254, 259, 260, 262, 263, 264
CC	191, 250, 267, 268, 269, 271
EE	251, 257, 274, 275, 276
GG	66, 255, 258, 265, 418
II	255, 258, 418
LL	258, 418
PP	190, 336
QQ	265, 418
TT	265, 272
DDD	273, 336
EEE	187, 189, 190, 273

Impacting Activity #26: Pesticides - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	175, 176, 215, 216, 217, 218, 313, 330
Y	75, 76, 176, 337, 339, 340
DDD	ND

Impacting Activity #27: Heavy Metals - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	133, 330, 343, 346
Y	341, 343
DDD	ND

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #28: Nutrients - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	136, 139, 184, 376
L	184
M	174, 184, 303, 308, 376
R	136, 174, 184, 196, 306, 307
Y	137
DDD	389

Impacting Activity #29: Thermal Effluents - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
H	182, 184, 231
I	231
R	144, 184
Y	184, 343
DDD	125, 144
EEE	125, 144
FFF	ND

Impacting Activity #30: Organic - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	184, 187, 338, 347, 367
L	147, 148, 149, 150, 151, 152, 158, 165, 166, 167, 168, 172, 185, 286, 287, 299, 312, 338, 345, 349, 375
O	194, 195, 277, 287, 288, 289, 309, 310, 311, 312, 361
P	184
Q	184
R	77, 145, 184, 194, 197, 286, 287, 299, 306, 307, 312, 316, 338, 362, 367
S	77, 145, 306, 338, 367
Y	74, 152, 299
DDD	389

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #31: Hazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	193, 194, 211
L	81, 280, 281, 350, 351, 357, 364, 366, 367
M	202, 350, 351
O	194, 357
P	351
Q	351
R	194, 353
S	351, 353
Y	211

Impacting Activity #32: Unconsolidated Non-Hazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	79, 80
M	3, 4, 5, 6, 24, 202, 206, 212, 279, 280
O	221
P	212
Q	12
R	13, 19, 20, 21, 40, 41, 42, 43, 83, 204, 205, 212, 279, 280
S	ND
V	ND
Y	35
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 187, 193, 202, 209, 214, 279, 280
CC	7, 11, 186, 193
EE	ND
FF	ND
GG	8, 17, 31, 37, 45
II	ND
KK	5, 10, 24, 31, 212

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #32: Unconsolidated Non-Hazardous - Solid Waste Disposal (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
LL	1, 2, 22, 23, 31
OO	ND
QQ	28
TT	ND
UU	ND
DDD	21, 28

Impacting Activity #33: Consolidated Non-Hazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	ND
M	351, 359
R	353, 357
S	ND
U	ND
Y	ND
Z	321, 322, 323, 366, 374
AA	366
BB	ND
CC	ND
DD	321
EE	ND
GG	ND
II	321
LL	ND
OO	ND
QQ	ND
TT	ND
VV	ND
DDD	ND

ND = Not Documented at this Time.

Table 1. Water (Contd.)

Impacting Activity #34: Particulates - Air Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
J	ND
L	314, 354, 355, 356, 368, 369, 370
M	314
O	314
P	314
Q	314
S	ND

Impacting Activity #35: Gases - Air Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	314
M	314
P	314
Q	314

Impacting Activity #36: Hazards

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
G	ND
H	ND
I	ND
L	151, 152, 153, 154, 155, 156, 157, 159, 160, 161, 162, 163, 164, 169, 170, 171, 173, 282, 286, 342, 343, 344, 352, 354, 355, 356, 358, 363, 364, 365
M	173, 286
O	277, 286, 288, 289
P	286
Q	286

ND = Not Documented at this Time.

Table 1. Water (Concluded)

Impacting Activity #36: Hazards (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
R	286, 287
S	ND
Y	152, 157, 160
PP	ND
QQ	ND
BBB	ND
DDD	ND
EEE	ND

* * * *

Table 2. Annotated Documentation for Edge Impacting Activities and their Subsequent Environmental Changes

Impacting Activity #1: Compaction

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
N	ND
Y	ND
AA	409
CC	409
EE	409
GG	408, 415
II	408, 415
LL	408, 415
NN	ND
WW	413

Impacting Activity #2: Woody Clearing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	92
X	ND
Y	ND
AA	398
CC	398
EE	398
GG	93, 398
II	93, 398
LL	93, 398
WW	92, 93, 97, 98
XX	92, 93, 98

Impacting Activity #3: Herbaceous Clearing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	92
X	ND
Y	ND
AA	398
CC	398
EE	398

ND = Not Documented at this Time.

Table 2. Edge (Contd.)

Impacting Activity #4: Herbaceous Clearing (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
GG	93, 398
II	93, 398
LL	93, 398
WW	92, 93, 97, 98
XX	92, 93, 98

Impacting Activity #5: Diking

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
D	ND
N	49, 65, 142, 266, 371
X	49, 142, 371, 380
AA	67, 282, 371, 396
CC	67, 282, 371, 396
EE	67, 282, 371, 396
FF	400
GG	84
HH	ND
II	400
KK	84
LL	142, 396
NN	380
RR	371
TT	ND
VV	ND
YY	380
AAA	142, 371, 380
BBB	ND
CCC	142, 371, 380
DDD	142, 371, 380

ND = Not Documented at this Time.

Table 2. Edge (Contd.)

Impacting Activity #6: Filling - Unconsolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108, 110
D	108
L	7, 12, 13, 15, 20, 30, 109, 134, 135, 203, 211, 348, 349
M	ND
N	ND
O	ND
U	ND
V	87, 108
Y	35, 108
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 87, 112, 187, 193, 202, 209, 214, 280
CC	7, 11, 112, 186, 193
EE	112
FF	389, 394
GG	8, 17, 31, 37, 45, 87, 108, 134
HH	389
II	112
KK	389
LL	1, 2, 22, 23, 31, 112, 278
NN	ND
RR	ND
SS	ND
TT	ND
UU	ND
VV	ND
WW	ND
YY	ND
AAA	ND
CCC	ND
DDD	21, 28, 108

ND = Not Documented at this Time.

Table 2. Edge (Contd.)

Impacting Activity #7: Filling-Consolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108
L	ND
M	405
N	405
U	ND
Y	108
Z	321,322,323,366,374
AA	366
BB	374, 388
CC	ND
DD	321, 374
EE	ND
GG	ND
II	ND
LL	ND
NN	ND
RR	ND
SS	ND
TT	374
VV	111, 374
WW	ND
XX	ND
YY	ND
AAA	ND
CCC	ND
DDD	ND

Impacting Activity #8: Excavating

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
C	103, 403
L	106
M	ND
N	103
U	103
V	103

ND = Not Documented at this Time.

Table 2. Edge (Contd.)

Impacting Activity #8: Excavating (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
Y	89, 104, 106
AA	94, 103, 104
CC	385
EE	385
GG	94, 103, 104, 402
II	402
LL	402
NN	103
SS	104
TT	104
VV	ND
WW	103
XX	103, 105
ZZ	ND
BBB	ND
DDD	89, 103, 406, 407

Impacting Activity #9: Impervious Surface

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	90
D	90, 99, 100
N	96
Y	96
AA	89, 95, 96, 100, 101
CC	89, 94, 95
EE	94, 95, 101
GG	89, 95, 96, 100
II	96
LL	96
NN	90, 96
RR	ND
SS	ND
TT	96
VV	ND
WW	90, 100
XX	96
YY	ND
DDD	99

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #10: Dredging

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
C	ND
L	7, 12, 13, 15, 20, 30, 81, 109, 134, 135, 203, 211, 280, 348, 349
M	3, 5, 6, 8
N	29, 31
O	221
U	ND
V	ND
Y	12, 13, 15
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 86, 87, 187, 193, 202, 209, 214, 280
CC	7, 11, 112, 186, 193
EE	112
GG	112
II	112
LL	1, 2, 22, 23, 31, 112, 278
NN	ND
SS	ND
TT	ND
VV	ND
XX	26,28, 31, 108, 112, 222
ZZ	ND
BBB	ND
DDD	21, 28, 108

Impacting Activity #11: Fertilizing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
M	ND

Impacting Activity #12: Insecticiding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	384, 395, 419, 420, 422, 423

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #13: Herbiciding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	324, 325, 326, 327, 328, 329, 419

Impacting Activity #14: Irrigating

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
Y	ND
AA	243, 244
CC	243, 244
EE	243, 244
FF	382
II	ND
KK	ND
LL	ND
NN	ND
XX	ND
DDD	244

Impacting Activity #15: Structural Support

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
N	ND
W	284, 285, 317
Z	ND
AA	113, 114, 387
BB	ND
CC	113, 114, 387
DD	ND
EE	113, 114, 387
GG	89, 113, 114
II	89, 113, 114
LL	89, 113, 114
NN	ND

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #15: Structural Support (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
RR	ND
SS	ND
TT	114
VV	ND
XX	114
YY	405
AAA	ND
CCC	405
DDD	89

Impacting Activity #16: Vehicular Traffic

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	370
AA	391, 392
CC	391, 392
EE	391, 392
GG	360,
II	360
LL	360
XX	360
GGG	391, 392

Impacting Activity #17: Water Transfer/Diversion

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
B	389
C	143
N	50, 66, 91, 107, 115, 142, 229, 266, 332
Y	ND
Z	48, 50, 57, 199, 219, 224, 372

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #17: Water Transfer/Diversion (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	48, 50, 57, 61, 62, 68, 70, 72, 110, 146, 177, 180, 183, 219, 226, 229, 232, 233, 234, 237, 240, 242, 243, 244, 245, 248, 290, 291, 297, 371, 372, 377
BB	50, 199, 200, 219
CC	50, 54, 55, 56, 58, 59, 60, 63, 64, 70, 72, 115, 121, 130, 177, 181, 199, 219, 227, 230, 239, 241, 331, 333, 373
EE	224, 225, 232
FF	66, 179, 219, 236, 378
GG	66, 107, 110, 115, 116, 118, 119, 120, 138, 179, 183, 219, 234, 235, 243, 378
HH	ND
II	ND
KK	ND
LL	118, 119, 120, 138, 178, 183, 300, 301, 302
NN	ND
RR	219
SS	219
TT	219
UU	ND
VV	ND
WW	107, 110, 371
XX	47, 49, 91, 107, 110, 219, 228, 371
YY	47, 49, 66, 219
DDD	47, 49, 66, 91, 142, 198, 219, 225, 371, 389

Impacting Activity #18: Inundation

Environmental Change Matrix Code letter(s)	Annotated Literature Citation #
A	ND
D	ND
L	107
Y	107
Z	ND
AA	107, 121
BB	ND
CC	107, 121

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #18: Inundation (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
DD	ND
EE	107, 121
FF	404
GG	107, 404, 427
HH	404, 427
II	107, 404
KK	ND
LL	107
NN	ND
SS	107
XX	107
ZZ	ND
BBB	ND
DDD	107

Impacting Activity #19: Landscape/ROW Management

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
Z	389
AA	ND
DD	389
FF	389
GG	389
HH	389
KK	389
LL	ND
NN	ND
XX	ND

Impacting Activity #20: Drainage

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	102
C	85, 102
Y	88

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #20: Drainage (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	85, 102, 117, 144, 145
CC	88
EE	ND
GG	83, 85, 102, 117, 144, 145
II	82
LL	82, 144
NN	ND
WW	102
XX	117
DDD	88, 102

Impacting Activity #21: Surface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
C	ND
DDD	50, 53, 55, 56, 62, 64

Impacting Activity #22: Subsurface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
C	416
DDD	416

Impacting Activity #23: Culverting

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	315
AA	95, 315
CC	95, 315
EE	95, 315

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #23: Culverting

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
GG	95, 315
II	95, 315
LL	ND
DDD	315

Impacting Activity #24: Channelization

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	143, 223
C	143, 223, 336
N	66
AA	95, 187, 233, 249, 252, 253, 254, 255, 260, 262, 263
CC	95, 191, 250, 267, 268, 269, 271
EE	95, 251, 257, 274, 275, 276
GG	66, 95, 141, 255, 258, 265
II	95, 141
LL	95, 141
RR	223
YY	ND
DDD	141, 143, 223, 335

Impacting Activity #25: Pedestrian Traffic

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	387, 392, 409
CC	387, 392, 409
EE	387, 392, 409
GG	409, 415
II	409, 415
LL	415
NN	415

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #26: Pesticides-Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	338, 384, 395, 419, 422, 423
DDD	ND

Impacting Activity #27: Heavy Metals - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	293, 338
DDD	ND

Impacting Activity #28: Nutrients - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	287, 338
M	287, 338
DDD	389

Impacting Activity #29: Thermal Effluents - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
AA	126, 127, 131, 132
CC	78, 140
EE	127, 132, 182
FF	124, 305, 421
GG	305
HH	304
II	ND
KK	124, 305, 421
LL	122, 123, 128, 129, 305
DDD	125, 144

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #30: Organic - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	286, 287, 294, 295, 299, 312, 338, 347, 349
O	194, 195, 277, 287, 288, 289, 309, 310, 311, 312, 361
DDD	389

Impacting Activity #31: Hazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	280, 281, 359, 364, 379
M	359, 379
N	ND
O	359, 379
Y	ND

Impacting Activity #32: Unconsolidated Nonhazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108
M	306,307,350,353
N	26, 223
U	ND
V	ND
Y	35
AA	7, 9, 10, 18, 21, 25, 27, 32, 33, 34, 38, 40, 44, 87, 112, 187, 193, 202, 209, 214, 280
CC	7, 11, 112, 186, 193
EE	112
FF	ND
GG	8, 17, 31, 37, 45, 87, 108, 134
HH	ND
II	112

ND = Not Documented at this Time

Table 2. Edge (Contd.)

Impacting Activity #32: Unconsolidated Nonhazardous - Solid Waste Disposal (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
KK	ND
LL	1, 2, 22, 23, 31, 112, 278
NN	26
RR	ND
TT	28, 108
UU	28, 108
VV	28
WW	ND
YY	ND
AAA	ND
CCC	ND
DDD	21, 28, 108

Impacting Activity #33: Consolidated Nonhazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
M	379
N	379
U	ND
Y	ND
Z	321, 322, 323, 366, 374
AA	366, 374
BB	374
CC	374
DD	321, 374
EE	374
GG	379
II	321, 379
LL	379
NN	379
RR	ND
TT	ND
VV	111, 374
WW	ND
YY	ND
AAA	ND
CCC	ND
DDD	ND

ND = Not Documented at this Time

Table 2. Edge (Concluded)

Impacting Activity #34: Particulates - Air Waste Bisposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	314, 351, 353, 354, 355, 356, 368, 369, 370
M	ND
O	ND
NN	ND
XX	ND

Impacting Activity #35: Gases - Air Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	370
M	ND
XX	ND

Impacting Activity #36: Hazards

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
C	ND
L	74, 77, 133, 135, 148, 149, 153, 154, 156, 158, 160, 185, 281, 282, 287, 330, 352, 353, 354, 355, 356, 357, 358, 359, 363, 364, 365, 379
M	287
O	287
NN	172
ZZ	282
BBB	282
DDD	282

* * * *

ND = Not Documented at this Time

Table 3. Annotated Documentation for Land Impacitng Activities and their Subsequent Environmental Changes

Impacting Activity #1: Compaction

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
AA	409
CC	409
EE	409
GG	408, 415
II	408, 415
LL	408, 415
NN	ND
WW	413
DDD	ND

Impacting Activity #2: Woody Clearing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	92
AA	398, 410
CC	398, 410
EE	398, 410
FF	93, 410, 412
GG	93, 398, 410
HH	93, 410
II	93, 398, 410
KK	ND
LL	410
WW	92, 93, 97, 98, 412, 417, 433
XX	92, 93, 98, 412, 428
DDD	92, 431

Impacting Activity #3: Herbaceous Clearing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	92
AA	398, 410

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #3: Herbaceous Clearing (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation
CC	398, 410
EE	398, 410
FF	93, 410, 412
GG	93, 398, 410
HH	93, 410
II	93, 398, 410
KK	ND
LL	410
WW	92, 93, 97, 98, 412, 417, 433
XX	92, 93, 98, 412, 428
DDD	92, 431

Impacting Activity #4: Plowing/Discing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
AA	ND
CC	ND
EE	ND
FF	ND
GG	ND
II	ND
KK	ND
LL	ND
MM	ND
YY	ND
DDD	ND

Impacting Activity #5: Diking

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
AA	84, 380, 394, 396, 400
CC	380
EE	380

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #5: Diking (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
GG	84, 380, 394, 396, 400
II	400
LL	84, 396
NN	380
YY	396
AAA	380, 396
CCC	380, 394, 396
DDD	380, 394, 396

Impacting Activity #6: Filling - Unconsolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108, 110
L	109, 134, 135
M	ND
N	ND
O	ND
AA	388, 393, 394, 424
CC	424
EE	388, 393
FF	389, 394
GG	388, 394, 424
HH	389
II	388, 424
KK	389
LL	112, 278, 394
MM	ND
NN	ND
WW	ND
YY	ND
AAA	ND
CCC	ND
DDD	509

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #7: Filling - Consolidated

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108
L	ND
M	405
N	405
AA	374, 388, 405
CC	374, 388
EE	374, 388, 405
GG	405
II	ND
LL	ND
NN	ND
WW	ND
YY	ND
AAA	ND
CCC	ND
DDD	ND

Impacting Activity #8: Excavating

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
C	103, 403
N	103
AA	385, 402
CC	385, 402
EE	381, 385, 402
GG	103, 385, 402
II	402
LL	402
NN	ND
XX	103
DDD	103, 406, 407

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #9: Impervious Surface

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	90, 99, 100
N	96
AA	96, 100
CC	96, 100
EE	96, 100
GG	96
II	96
LL	96
NN	90, 96
WW	90,96, 98, 100
YY	ND
DDD	90, 96, 99, 100

Impacting Activity #11: Fertilizing

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
M	ND

Impacting Activity #12: Insecticiding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	384, 395, 419, 420, 422, 423

Impacting Activity #13: Herbiciding

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	324, 325, 326, 327, 328, 419

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #14: Irrigating

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
FF	382
HH	382
KK	ND

Impacting Activity #15: Structural Support

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	387
CC	387
EE	387
GG	405
II	405
LL	405
YY	405

Impacting Activity #16: Vehicular Traffic

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	370
M	ND
AA	391, 392
GGG	391, 392

Impacting Activity #17: Water Transfer/Diversion

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
B	389
C	ND
D	ND
DDD	389, 399

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #18: Inundation

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
AA	107, 121
CC	107, 121
EE	107, 121
GG	107, 120, 247, 404, 427
II	107, 120, 247, 427
LL	107, 247, 427
NN	ND
XX	107
YY	115

Impacting Activity #19: Landscaping/ROW Management

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
FF	389
GG	389
HH	389
II	ND
KK	ND
LL	ND
WW	510

Impacting Activity #20: Drainage

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	102
N	ND
Z	ND
BB	ND
DD	ND
FF	425
GG	82, 425
HH	425
II	82, 425
KK	ND
LL	82

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #20: Drainage (Contd.)

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
WW	399, 417
DDD	399, 425

Impacting Activity #21: Surface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
C	ND
DDD	50, 53, 62, 64

Impacting Activity #22: Subsurface Water Demand

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
C	416
DDD	416

Impacting Activity #23: Culverting

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	315
AA	ND
GG	ND
LL	ND
DDD	315

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #24: Channelization

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	418, 432
C	143, 223
AA	95, 418, 432
GG	95, 418, 432
LL	95
XX	223
YY	ND
DDD	418, 432

Impacting Activity #25: Pedestrian Traffic

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
AA	387, 392, 409
CC	387, 392, 409
EE	387
GG	409, 415
II	415
LL	415
NN	415

Impacting Activity #26: Pesticides -Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	338, 384, 395, 419, 422, 423
DDD	ND

Impacting Activity #27: Heavy Metals - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	338, 399
DDD	399

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #28: Nutrients - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	287, 338
M	287, 338
DDD	389

Impacting Activity #29: Thermal Effluents - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
FF	305, 421
GG	305
HH	ND
II	ND
KK	305
LL	305
DDD	ND

Impacting Activity #30: Organic - Liquid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
A	ND
L	287, 338
O	287, 411
DDD	389

Impacting Activity #31: Hazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	350, 353, 359, 364, 365
M	350, 353, 359, 379
O	350, 359, 379

ND = Not Documented at this Time

Table 3. Land (Contd.)

Impacting Activity #32: Unconsolidated Nonhazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	108
M	350, 353
N	223
AA	379, 389, 424
CC	ND
EE	379, 424
FF	ND
GG	379, 424
HH	ND
II	379, 424
KK	ND
LL	424
MM	ND
NN	ND
WW	ND
YY	ND
DDD	108

Impacting Activity #33: Consolidated Nonhazardous - Solid Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
M	379
N	379
AA	ND
CC	ND
EE	ND
GG	379
II	379
LL	379
NN	ND
WW	ND
YY	ND
DDD	ND

ND = Not Documented at this Time

Table 3. Land (Concluded)

Impacting Activity #34: Particulates - Air Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	368, 369, 370
M	ND
O	ND
NN	ND
XX	ND

Impacting Activity #35: Gases - Air Waste Disposal

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
L	370
M	ND
XX	ND

Impacting Activity #36: Hazards

Environmental Change Matrix Code Letter(s)	Annotated Literature Citation #
B	ND
C	ND
L	135, 149, 153, 156, 157, 158, 185, 281, 287, 330, 345, 350, 353, 359, 364, 365, 379
M	287, 350, 353, 359, 379
O	287, 350, 353, 379
NN	172
ZZ	282
BBB	282
DDD	282

ND = Not Documented at this Time

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Annotated Literature Citations for Documentation Matrices

1. Ingle 1952: Dredging effects on primary production. Reported reduced primary production near dredged channels in highly turbid area.

2. Chesapeake Biological Laboratory 1970: Reduction in phytoplankton primary production in vicinity of dredge channels is only temporary.

3. Windom 1973: Ammonia enrichment was result of estuarine dredging.

4. Chesapeake Biological Laboratory 1970: 1000 x increase in total phosphorus and 50 x total nitrogen in the water over dredge spoils in Chesapeake Bay.

5. Subba Rao 1973: Nutrient remobilization during dredging produced 3-13 fold increase in primary production in tropical coastal lagoon.

6. Kaplan et al. 1974: After dredging ended, no increase in phytoplankton occurred despite increase in nutrients.

7. Pequegnat 1978: Toxic effects of dredging on zooplankton in near-shore environments may occur due to buildup of toxics in dredged material and transfer through food chain. Demersal fish are also expected to be affected-through reduced abundance and reproduction.

8. Pequegnat 1978: Phytoplankton blooms may occur at inshore dredging sites due to nutrient release. Also may expect flocculation of phytoplankton by fine sediments.

9. Stickney 1973: Fish avoided areas of high turbidity; no mortality found in field studies at dredge sites; laboratory studies showed heavy mortality caused by gill clogging.

10. Ritchie 1970: No mortality in 11 fish species held in cages at dredge site: striped bass experienced heavy mortality; channel catfish almost no mortality.

11. Pequegnat 1978: Many demersal fish lay their eggs in benthic substrate-cod, hake, haddock, and herring (all commercial species) and would be affected by dredging and filling activities.

12. Darnell 1976: Reduced pH generally increases heavy metal solubility; this occurs under anaerobic conditions produced by dredging; also CO_2 level rises, carbonate drops. Construction activities which increase metal levels in water or sediments: mining (direct addition via runoff); ditching; dams (accumulate in sediments)(and hypolimnion); dredging resuspension; channelization precipitates where fresh and marine water mix.

13. Darnell 1976: Hydrogen sulfide content in water increased by construction activities that increase siltation, lower oxygen and pH, and stir up bottom sediments. Also release of hypolimnetic water for dams, channelization of coastal waters, mining and operations that reduce circulation.

14. Darnell 1976: Rise in turbidity caused by dredging increases CO_2, reduces pH; reduced circulation or organic enrichment will have same effect.

15. Schindler et al. 1972: Anaerobic sediment/water releases heavy metals as water soluble organic metal complexes.

16. Williams 1966: suspended solids can remove zooplankton by physical adsorption on clay particles.

17. Lackey et al. 1959: 99% of all phytoplankton in sample were removed by clay suspension in 20 minutes in laboratory experiment.

18. Darnell 1976: Suspended particles can remove critical plant nutrients by adsorption and can also remove phytoplankton.

19. Darnell 1976: Suspended sediments can produce temperature increases and can inhibit vertical mixing by stratifying water column; this also reduces dissolved oxygen level.

20. Darnell 1976: Suspended sediments reduce oxygen by increasing microbial respiration, inhibition of photosynthesis, inducing the stratification effect or releasing reduced sulfides which become oxidized, thus, there is both COD and BOD. This process also lowers pH through CO_2 production in poorly buffered systems.

21. Odum 1970: Dredging modifies estuarine circulation patterns where extensive spoil banks are created. Long spoil banks especially block circulation patterns and can cause reduced DO, reduced benthos, and increased sedimentation and shoaling.

22. Robillard and Porter (in Zieman 1978): Showed that eelgrass (Zostera marina) could tolerate a 20% reduction in light intensity if turbidity was only temporary.

23. Odum 1963: Seagrasses could not grow if buried by 30 cm sediment; sedimentation can also reduce seagrass production/abundance by artificially raising the bottom (shoaling).

24. Odum 1963: Smothering by silt due to dredging killed seagrasses. In areas not completely smothered later increases in production occurred probably due to increased nutrient supplies.

25. Cronin et al. 1970: Recorded a 64% reduction in benthic fauna biomass and 71% reduction in numbers in area affected by dredge spoil.

26. Cronin et al. 1970: Showed spoil disposal material from Chesapeake dredge project covered an area 5 times as large as the original disposal site.

27. Tabb et al. 1962: In Florida, higher salinity caused by deep dredged channels can favor some forms of adult fish; sea trout, redfish; but reduce survival of larval shrimp, menhaden and oysters due to salinity changes.

28. Zieman 1978: Dredged channels or spoil area can cause current velocity and direction changes eroding some areas and filling in others.

29. Schubel 1973: Destruction of seagrasses by dredging causes destabilization of bottom sediments and adverse changes in sediment composition.

30. Zieman 1978: Dredging/filling reduces oxygen by consumption by microbes associated with slowly settling resuspended sediments and releasing sediments with high COD. Fine organic sediments strongly adsorb various chemicals ranging from heavy metals to pesticides; under reducing conditions these are released.

31. Thayer et al. 1975: Destruction of seagrasses results in increased water turbidity, resuspension of bottom sediments, decreases in phytoplankton/macroalgae production/abundance associated with beds. Some enhancement of production also may occur due to redistribution of sediments high in nutrients.

32. Flemer et al. 1967: Noted a 71% reduction in mean density of benthos in Chesapeake Bay spoil area following dredging, and erratic population changes in months after.

33. Taylor and Saloman 1969: Estimated that destruction of 1100 metric tons of <u>Thalassia</u> (seagrass) due to dredging/filling in Florida resulted in the immediate loss of 1800 metric tons of infauna, 73 tons of fisheries products, and 100 tons of future infaunal productivity.

34. Phillips 1974: Related the decline in eelgrass (<u>Zostera</u>) abundance to reduction in abundance of associated invertebrates and fish.

35. Thayer et al. 1975: Dredging/filling in seagrass beds causes a change in sediment redox potential which may retard plant growth.

36. Thayer et al. 1975: Filling in seagrass beds reduces plant abundance by smothering, reduced light intensity or increased effects of toxic materials in dredged sediments.

37. Briggs and O'Connor 1971: Spoil areas of Long Island Sound lacked benthic plants but nearby undisturbed areas were populated by seagrasses.

38. Taylor and Saloman 1969: Showed that channels that were deeply dredged in Florida had 20% fewer number of species of fish than unaffected Bay areas.

39. Zieman 1978: Reduced light caused by turbidity during dredging can cause reduced DO by reducing photosynthesis of grass. Turbidity can also increase water temperature due to greater solar radiation absorption.

40. McNulty 1961: 28 year old dredge depression in South Biscayne Bay remains barren and anoxic due to restricted circulation and stratification.

41. Ingle 1952: Found DO affected only in area within 0.23 miles of dredging operation.

42. Hellier and Kornicher 1962: Recorded negative biological effects of dredging greater than 0.5 miles away.

43. Brown and Clark 1968: DO values were 16 to 83% lower than normal near dredging operations.

44. Breur 1962: Dredge and fill closed off South Bay from Gulf of Mexico causing reduced circulation, increased sedimentation, and destruction of fisheries.

45. Copeland 1965: Reduced light from 1500 to 200 ft candles in Thalassia community caused a shift to bluegreen algae community which provides poor food for fish, etc. ...

46. Darnell 1976: Seawater penetrating canals traversing marshlands produces increased H_2S due to mixing of soluble sulfides in seawater with lower pH freshwater.

47. Nelson 1960: Diversion of river water reduces river flow and increases flow in receiving basin.

48. Gunter and Hall 1963: Controlled periodic release of freshwater from lake Okeechobee to St. Lucie estuary enhanced fisheries production due to increased nutrient input. Increases in croaker, mullet, anchovy and menhaden.

49. Gunter 1952: Levees cause faster runoff, more silt transport but sedimentation and flooding of marshes, swamps, and the estuary were reduced; greater amounts of silt were transported to Gulf of Mexico.

50. Nelson 1960: Diversion produced increased salinity and increased numbers of oyster drills plus damaging nutrient loss to estuary.

51. Carpenter and Cargo 1957: Changes in river flow (increased flow) caused stratification during summer in Chesapeake, killed off benthos.

52. Pritchard 1955: Increased flow in estuary during summer can increase stratification of Chesapeake and cause reduced DO in bottom layers.

53. Ketchem 1951: River flow changes upset salinity pattern in estuaries: decreased flow raises; increased flow lowers salinity.

54. Smith 1949: Turbid streams are barrier to migrating salmon.

55. Tabb et al. 1962: Adult pink shrimp stayed in estuary during a high salinity year produced by combination of water diversion projects in Florida and a dry year; demonstrating the effect of man and the hydrologic cycle on shrimp production and reproduction.

56. Odum 1970: Reduction of freshwater input may reduce populations of estuarine animals by elimination of vital chemical cues needed to stimulate migration into estuaries of adults which spawn there. This includes shrimp primarily but would also include salmon.

57. Darnell 1976: Elevation of salinity in estuaries may allow marine predators, competitors, diseases and parasites of valuable estuarine fauna to enter from the ocean waters.

58. Odum 1970: Limitation of freshwater inflow by current/circulation alteration can interfere with larval migration which requires strong bottom currents (upstream).

59. Copeland 1966 : Peak inward migration of larval penaeid shrimp coincides with maximum spring river runoff; modifying flow would reduce shrimp populations.

60. Copeland 1966 : Reduction of freshwater input to the estuary reduces animal and plant populations.

61. Gunter et al. 1974: Hypersaline conditions reduce populations of most estuarine organisms.

62. Calhoun 1953: Young striped bass killed en masse by water diversion in Sacramento River drainage basin.

63. Gangmark and Bakkala 1960: Unstable stream flow in Sacramento River killed 99% of Salmon fry over several years.

64. Creutzberg 1961: Reduced stream flow rate prevents or retards fish migration due to masking of olfactory compounds.

65. Gunter 1957: Reduced nutrients, recruitment and water exchange occurs on the landward side of levees.

66. Thayer et al. 1975: Clearing of agricultural lands and channeling streams increases erosion rates, increases sedimentation, and reduces salinities in estuaries; all which reduce abundance of seagrasses. Stream diversion may have opposite effect by increasing salinity and decreasing turbidity. However, some seagrasses would be favored and others not since each species has its own salinity preference (also reduced nutrient inflow would affect primary production).

67. Frankenberg 1968 : Construction of a dike 3' x 12' wide would produce enough sediment to remove all DO from 2,437 ft^3 water (4.8 mg/1); adversely affecting fauna in the area.

68. Moore and Trent 1941: Channelized marsh reduced oyster growth by 27%, and increased mortality 39%.

69. Smith 1970: H_2S produced in deeper channels (dredged) is toxic to benthos and vegetation.

70. Darnell 1976: Acid conditions in canals may induce release of heavy metals from sediments. Overall effect of canals is to decrease aquatic animals due to habitat loss, decrease food supply by lower DO, increasing salinity and H_2S concentrations.

71. Taylor and Saloman 1969: Channelization produces an environment in which fine sediments, silt and detritus accumulate, the result of which is often eutrophic and/or anaerobic conditions.

72. Lindall 1973: Channelization produces an environment unsuitable for benthos colonization even after ten years in some cases.

73. Erickson 1972: Examined toxicity of Copper on Thalassiosora, a marine diatom using bioassay method; effects on reproduction, production were noted.

74. Steed and Copeland 1967: Low concentrations of petrochemical wastes depressed fish metabolism. Slightly higher concentrations had reverse effect (aberrant growth rates).

75. Butler 1966 : Oysters concentrate DDT from water in their pseudofeces and through biodeposition change sediment chemistry.

76. Odum 1970: Fine detritus in sediment can concentrate 100,000 x DDT which is transferred to the consumers of detritus and algae.

77. Biggs 1975: Industrial wastes usually have high BOD; which can be reduced by 80 - 90% by secondary treatment. However, 0.75 lb sludge/lb BOD is produced.

78. Muchmore and Epel 1973: Unchlorinated sewage weakly inhibited sea urchin fertilization, chlorinated sewage had 100% inhibition of fertilization.

79. Carpenter and Smith 1972: Large pieces of polyethylene plastic have been found floating in the Atlantic; up to 300 gms/km^2.

80. Carpenter et al. 1972: Extensive occurrence in Atlantic Ocean of plastic spheres (polystyrene) 0.1-2.0 mm diameter in concentrations from 0.05 to 2.25 $spheres/m^3$; contain PCB's adsorbed from seawater; found in guts of larval fish, winter flounder, and other species.

81. Lear and Pesch 1975: Sewage sludge dumping in open ocean area off Delaware Bay introduces large amounts of metals into marine environment; concentrate in benthic organisms- clams and scallops- lead, cadmium, copper, zinc included; these are translocated to a larger area by hydrographic forces.

82. Marshall 1974: Ditching of Juncus marsh resulted in the invasion of woody species of plants; lowered production, increased stagnation, and increased sedimentation.

83. Brown and Clark 1968: Dredging in Raritan Bay lowered DO 16-83% below normal; apparently caused by reaction of sulfides in sediment with oxygen.

84. Provist 1968: Effects of diking on salt marsh: shrubby salt water plants replaced freshwater species (or brackish plants); productivity increased in this case; impoundments became favored habitat for birds and fish; populations increased.

85. Bourn and Cottam 1950: Effects of drainage of marsh for mosquito ditching: reduction in Spartina abundance; replacement of Spartina with shrubby less productive terrestrial species; reduced insects, mollucs, crustaceans, some reduced 90%; lowered water table; flooding increased; reduced nutrient export to estuary.

86. Cooper 1974: Effects of dredging and filling marsh in North Carolina: runoff from dredge spoil piles killed large numbers of oysters, clams, and crabs in area; runoff covered large area.

87. Chapman 1967: Filling: direct result is loss of marsh habitat; reduction in plants and animals.

88. Clark 1977: Rookery Bay Florida: ecological results of draining wetlands: disruption of natural flow patterns; reduced water cleansing function of vegetation; increased salinity variation; potential reduction in estuarine water quality during heavy rains; increased sedimentation; increased nonpoint runoff due to increased erosion (increased pesticides, nutrients, heavy metals); increased BOD, reduced DO; increased coliforms/pathogens; reduced reproductive success of estuarine fish/shellfish.

89. Clark 1977: Highways placed on structures in wetlands have the following effects: removal of habitat; disrupt faunal movements; segment habitats; removal of deep organic sediments and replacing them with solid structures may alter subsurface drainage pattern (cutting through aquifer and polluting it).

90. Darnell 1976: Paving and impervious surfaces lower stream levels and flow rates during dry weather; increases runoff during during rainy weather.

91. Darnell 1976: Effect of dams on estuaries: reduced frewhwater input; reduced peak flow rates; reduced flushing; caused abnormal seasonal flow regime; reduced sediment stream input; sediment accumulation; increased sediment accumulation in reservoir; changed bottom topography; built up sediment toxics; changed circulation patterns; reduced nutrient export to estuary; reduced sediment transport and increased beach erosion; increased nitrogen content below dam due to spillway mixing.

92. Darnell 1976: Denuded areas lose great amounts of nutrients, dissolved organic solids, increased groundwater discharge and spring flow; reduced spring flow may also occur is water table is lowered far enough; reduced aquifer recharge may occur too.

93. Chapman 1962: Removal of vegetative cover by forestry can produce increased erosion and runoff.

94. King and Ball 1964: Gravel washing produces large amounts of highly turbid water; destruction of benthic habitat and benthic fauna.

95. Elser 1968: Roads, railroads etc. ... usually require straightening of stream, destruction of benthos and stream habitat.

96. Darnell 1976: Summary of effects of impervious surfacing on edge environment: loss of habitat; reduced fertility of soil; increased erosion; lowered water table; increased changes in stream levels; increased stream turbidity; changes in water chemistry (toxics, salts).

97. Hobbie and Likens 1973: 26% increase in surface runoff from recently devegetated forests.

98. Branson 1970: "Spectacular" increase in sediment runoff from devegetated Arizona floodplain.

99. Bayly and Williams 1973: Impervious surface can cause changes in groundwater flow so that during dry season the stream dries out completely.

100. Darnell 1976: Possible long term effects of impervious surfacing: permanent loss of natural edge habitat; increased surface runoff; decreased groundwater discharge; chemical changes in stream caused by leaching from car exhaust.

101. Darnell 1976: Other effects of highway construction and impervious surfacing: increased sediment load clogs riffles, kills benthos; increased turbidity reduces light penetration; causes increased BOD/COD.

102. Darnell 1976: Effects of drainage ditches in wetlands: increased runoff; removal of vegetation; erosion of native soil; lower water table; increased current velocities; erosion in stream due to greater sediment load; spoil banks may increase erosion; breeding of feeder ditches; increase downstream flooding; reduction in flora and fauna; rapid changes in water levels.

103. Darnell 1976: Effects of mineral extraction: removal of natural cover; removal of topsoil; exposure of rock surfaces; creation of spoil banks which seep and erode; increased surface runoff, erosion; lowered groundwater level.

104. Darnell 1976: Physical effects of mineral extraction on wetlands: drainage of wetland; filling of wetland with spoil/tailing; channelization of stream; stream diversion, impoundment; increased silt load, turbidity; decreased light penetration; reduced habitat diversity.

105. Spaulding and Ogden 1968: Appalachia strip mines produce 34 million tons of sediment per year.

106. Darnell 1976: Chemical effects of mineral extraction on wetlands: addition of chemical elements to wetland, including heavy metals, radioactive materials, sulfides or other reduced materials; increased salt content of wetland waters; possible additions of sulfuric acid, reduction in pH; reduced buffering capacity of receiving water; heavy metals placed in solution; reduced DO; contaminated groundwater.

107. Darnell 1976: Upstream effects of dam construction: habitat loss through flooding of floodplain, tributaries etc. ...; erosion of banks; leaching of soluble materials from basin; initial increase in nutrients; devegetation of wide band around waters edge caused by water level changes; increased sediment runoff.

108. Darnell 1976: Effects of filling in wetlands: reduced surface flow through wetland; spoil banks and canal erosional problems; loss of wetland habitat; increases in salinity below fill, decreases above.

109. Darnell 1976: Effects of spoil placement and dredging in wetlands: modification of bottom topography; creation of dredge holes (maybe anoxic), channels etc. ...; changes in circulation patterns (usually decrease); increase turbidity; increase BOD; decrease DO; reduce light penetration; reduced photosynthesis; release of organic compounds from spoil; release of pesticides and heavy metals from spoil, H_2S; increased temperature, increased sedimentation.

110. Darnell 1976: Effects of channelization and spoil placement on marshes: increases surface drainage and erosion caused by canals; spoil banks dam surface drainage; increased runoff; loss of habitat and reduced floral and faunal abundance caused by channelization, water table lowering, erosion, spoil coverage, marsh subsidence; increased salinity; increased sulfides in canals; erosion of spoil piles, introduction of reduced sediments into canals.

111. Cronin et al. 1971: Interruption of littoral drift by groins.

112. Darnell 1976: Beach nourishment makes several problems: removal of sand from the nearshore shelf increases slope and thus increases erosion; removal of material from behind dike eliminates lagoonal habitat, reduces flora and fauna abundance, diversity, production; repeated nourishment means repeated damage.

113. Sykes 1971: Wharves, piers and bulkheads permanently remove intertidal, subtidal edge habitat; these are often the most productive areas of the estuary.

114. Darnell 1976: Wharves, piers and bulkheads may require submerged dredging; it takes 3 acres of submerged sediments to make 1 acre of filled land; reflected waves on any vertical surface such as these stir up sediments; in cases of extensive construction, blind stagnant channels may be created too.

115. Gunter 1957: Levees prevent riparian areas from receiving annual flooding and nutrient replenishment; prevents flora and fauna recruitment; caused drainage of devegetated areas.

116. Darnell 1976: Most riparian plant species are sensitive to small changes in water levels; changes in species diversity and abundance result from water level changes caused by dams or diversion.

117. Barstow 1970, 1971: Drainage of riparian lands in Tennessee caused: elimination of woodland and wetland habitat; decline in frequency/intensity of flooding; reduced soil moisture; increased erosion; 70% reduction in edge habitat; 95% reduction in furbearers; 75% reduction in edge species of animals; estimated 4 million dollars in wildlife and habitat losses.

118. Bourn and Cottam 1950: Lowland vegetation is sensitive to small water level changes; changing water levels above or below a dam will reduce flora and fauna abundance.

119. Roebeck et al. 1954: Changes in water levels prevent the natural development of shoreline vegetation; reduced abundance and production.

120. Braun and Beland 1958: Submergence kills emergent plants; as in periodic releases from dams, resulting in changing water levels.

121. Wolf 1955: Changing water levels in dams and receiving waters damage bird nests, reduces hatching success; leads to nest destruction.

122. Carpenter et al. 1972: 83% decrease in phytoplankton productivity in plants entrained by Long Island Sound nuclear plant (water chlorianted 1.2 mg/l; 0.4 mg/l residual at discharge). No decreases when no chlorine.

123. Gentile 1972: 50% reduction in phytoplankton exposed to chlorine 0.075-0.25 mg/l 24 hours.

124. Jensen et al. 1974: Thermal effluent: small Mid-Atlantic estuary (Delaware): no change in O_2, no affect on diversity/abundance. Increase in algae productivity during cooler months. Lack of effect due to a temperature change of only 10.8°. Natural salinity range had greatest influence on abundance and diversity.

125. Jensen 1974: In small bays/estuaries: large withdrawals of cooling water for power plant use has caused circulation changes.

126. Strawn and Gallaway 1970: Blue crabs increased in vicinity of power plant due to increased winter temperatures and improved circulation. Brown shrimp negative effect. White shrimp overall beneficial effect.

127. Warriner and Brehmer 1966: Decreased abundance and diversity of benthos of Virginia estuary within 980 ft. of power plant discharge.

128. Mihursky 1967: Chlorination from power plant reduced phytoplankton.

129. Patrick 1968: No change in diversity of flora in thermal plume; reduction of phytoplankton abundance by 88%.

130. Miller and Collins 1954: Ducks nest near water; flooding caused by periodic water level changes in dams and receiving waters cause nest destruction.

131. Maryland Department Resources 1969: Thermal effluent study; Patuxent River estuary; local striped bass populations increased, white catfish and hog choker declined; white perch constant. Sport fishing increased during winter.

132. Tabb and Roessler 1970: Reduction in benthic algal abundance and diversity caused possibly by scouring in discharge area; reduction in benthic invertebrate diversity and abundance (and fish) in area related to thermal plume.

133. Lackey and Lackey 1972: Detected high (15 mg/l) copper levels in water which may have been responsible for one fish kill in June 1969; copper plus low salinities caused the kill.

134. Bramble and Ashley 1955: Even after 35 years acid spoil bank vegetation is still very sparse.

135. Parsons 1968: Spoil piles continue to leach H_2SO_4 and heavy metals for several years (mine spoil piles).

136. Carpenter, Pritchard, and Whaley 1969: Serious drop in water quality due to excessive nutrient load on Black River - receives Baltimore sewage - algal blooms - DO drop; Nuisance submerged aquatic plants produced.

137. Odum 1970: Nutrient trap effect in estuaries due to: 1. High % clay minerals with great adsorptive ability; 2. Extensive biodeposition, recycling; 3. Circulation/mixing patterns trapping nutrients.

138. Hall et al. 1946: Waters edge vegetation is very sensitive to water level changes, water depth, degree of exposure and timing on an annual basis of these events; dams reduce abundance of these plants through constantly changing water levels.

139. Ryther 1954: Decline in oyster and fish production in Great South Bay related to growth in duck industry which produced blooms of algae but which were unsuitable as oyster food. Mixed species diet required for adequate growth.

140. Major and Mitchell 1966: Water temperature in part exerts control over timing of salmon migration.

141. Darnell 1976: Channelization eliminates edge vegetation by erosion of filling and dredging; increased flood potential.

142. Darnell 1976: Effects of levees: cuts off freshwater inflow; prevents freshwater flooding; prevents annual flooding; prevents renewal of nutrients/sediments; prevents new marshes from forming.

143. Darnell 1976: Effects of canals on coastal marshes: carry off freshwater drainage; block freshwater flow across seaward side of canal; cause rapid removal of freshwater to bay; lower water table; increase groundwater salinity.

144. Bourn and Cottam 1950: Drained coastal marsh in Delaware studied over 10 year period: wetland replaced by dry land plant and animal species; land converted to low wildlife value type; reduced primary and secondary animal and plant production.

145. Darnell 1976: Drainage or elimination of marshlands reduces detrital export to estuary by eliminating plants; this in turn affects valuable detritus based fisheries; marsh becomes heterotrophic consumer, flora/fauna reduced.

146. St. Amant et al. 1958: Lack of freshwater caused by channelization damaged production of furbearing animals and birds.

147. Kauss et al. 1973; Parker 1974: Reduction of phytoplankton abundance due to oil.

148. Rice 1973: Oil interferes with chemotaxis of salmon - and therefore spawning.

149. Blumer et al. 1971 : Juvenile blue mussels in the area of an oil spill did not reproduce following year.

150. Parker 1974: Sand dollar eggs failed to develop; affected by oil in laboratory tests.

151. La Roche 1973: Gonadal tumors in soft shell clams near oil spill.

152. Blumer 1971: Oil flocculated with mineral/clay suspended material in water; sank to sediment where it exerted toxic effects on benthos for more than a year.

153. Smith 1968: 40,000-100,000 seabirds killed by Torrey Canyon oil spill.

154. Spears 1971: Production of fish and shrimp reduced in water polluted by oil industry.

155. Sponner 1978: Marine larvae often are more susceptible than adults to oil.

156. North et al. 1965: Rocky intertidal community animals almost all killed by massive oil spill (Tampico Maru).

157. Copeland and Steed 1974: Texas coastal areas receiving oily wastes are characterized by reduced species diversity, large daily changes in DO, anaerobic bottom conditions.

158. Baker 1973: Oil refinery effluents had significant negative effects on benthos in enclosed bay via O_2 lowering; effluents in exposed open areas had less effects.

159. Boesch et al. 1974: Cites evidence for oil maintaining low biomass, low diversity of biological community.

160. Blumer et al. 1971: 4 years after West Fallmouth oil spill (#2 fuel oil) bottom still grossly polluted- an increase in polychate worms was noted (an extremely hardy species of Capitellid worm); they estimated 5-10 years were needed for complete recovery to occur.

161. Nicholson and Chinberg 1971: Massive kill of barnacles caused by Santa Barbara oil spill.

162. North et al. 1965: Extensive kill of benthic marine organisms as result of Torrey Canyon oil spill.

163. Boesch et al. 1974: Oil spills have drastic immediate effects on intertidal orgaisms but within several years they recover due to the hardiness of these organisms, their rapid reproduction, and rapid removal of oil by wave action in the intertidal.

164. Smith 1968: Phytoplankton killed off in large numbers as result of Torrey Canyon oil spill; major disasterous type of spill.

165. Galstoff 1935: Phytoplankton growth inhibited by oil.

166. Aubert et al. 1969: Marine phytoplankton growth inhibited by oil.

167. Strand et al. 1971: Marine phytoplankton growth and photosynthesis inhibited by oil.

168. Gordon et al. 1973: Photosynthesis of marine phytoplankton inhibited by oil (60-200 ppb); between 10-30 ppb it was stimulated.

169. Neushal 1970: Surf grass suffered heavy damage in Santa Barbara oil spill (seagrass).

170. Nelson and Smith 1972: Killing off of grazing invertebrates in oil spill resulted in increase in green algae which had been fed on by animals.

171. North et al. 1965: Tampico Maru oil spill killed urchins which normally ate kelp sporelings; kelp then greatly increased in the affected area following the spill (however, kelp distribution was not normal for 6 years).

172. Baker 1970; 1971: Chronic oil spill can kill marsh plants and cause erosion.

173. Patten 1962 : Reduced diversity of phytoplankton as function of increasing sewage pollution.

174. Barlow et al. 1963: Moriches Bay Long Island Sound: eutrophication of estuary due to excessive sewage nutrients; result was lowered DO; extended anaerobic conditions.

175. Bourdreaux Strawn and Gallas 1959: Hepatchlor sprayed to control fire ants contaminated irrigation canals/streams, killing fish directly or indirectly; heavy mortality of birds and mammals too; 100% kill in some areas.

176. Harrington and Bidlingmayer 1958: Documented details of estuarine dieldrin kill: extensive fish die-off; invertebrates too; result of runoff from spraying operation.

177. Moore and Trent 1971: Channelized marsh reduced oyster production by 90%, mortality was increased by 39%.

178. Copeland 1967b: Laguna Madre impoundment: decreased productivity; increased sedimentation rates; increase salinity; reduced circulation; caused reduced mixing/exchange.

179. Copeland 1974: Dikes built in New Jersey marshes change salinity structure (reduced salinity); Spartina patens then replaced S. alterniflora as result of changing salinity and water level.

180. Tabb et al. 1962: Drainage and diversion in Florida caused increased salinity in Everglades estuary, decreased fish and shrimp production, induced changes in community as result.

181. Copeland 1974: Hurricane dikes changed circulation/mixing; caused salinity to decrease above dike as freshwater diluted water.

182. Brehmer 1966: Species diversity of benthic fauna was lowered within several hundred yards of heated waste water discharge.

183. Copeland 1974: Closing off of Great South Bay (Long Island) destroyed oyster populations caused by lack of circulation, eliminated seagrasses; turbidity increased due to increased dredging, sedimentation; also increased sedimentation caused by decreased wind mixing.

184. Wilkes and Copeland 1974: Effects of pulp mill wastes: exerts immediate high BOD/COD; changes in pH; increased turbidity; temperature increases; toxic waste increase; smothering of benthic animals.

185. Copeland and Steed 1974: Petrochemical waste effects: 1. Toxicity causes massive fish kills (localized); 2. Decreased flora/fauna diversity; 3. Increases/decreases in productivity.

186. US Fish and Wildlife Service 1967: Dredging and filling destroyed more than 200,000 acres of shallow nursery grounds in Gulf and South Atlantic over last 20 years.

187. St. Amant et al. 1958: Channelization/dredging causes increased salinity by increasing direct flow of salt water into marshes, and of freshwater out; result is salinity that is too high for oysters.

188. Chapman 1967: Documents salt water intrusion during low fresh-water runoff in Galveston Bay due to channelization/dredging.

189. Ryther et al. 1957: Improvement in oyster production due to reopening Moriches Inlet in New York- improved exchange with ocean, increased nutrient inflow, food supply for oysters; improved salinity regime.

190. Chapman 1967: Channelization does have some good results, in certain cases: nursery areas produced by connecting isolated areas of the bottom land to the estuary; prevention of massive mid-winter dieoff (or midsummer dieoff) due to temperature changes (i.e., fish survive in deeper channels because water does not change temperature as rapidly); release of nutrients from sediments.

191. Mansueti and Kolb 1953: Following channelization of St. Johns River the Shad relocated their spawning grounds 20 miles upriver.

192. Sykes and Finacaue 1965: Filled bay in Florida supported fewer fish and shellfish; however, pollutants also greater in filled bay too, effects thus caused by both factors.

193. Marshall 1967: Dredging and filling cause: 1. Direct destruction of valuable wetlands; 2. Destruction of valuable nursery/ spawning areas; habitat for fish and shellfish by siltation; 3. Reduced light penetration; 4. Reduced nutrient flow out of marshes/swamps.

194. Wastler 1967: Organic sewage and pulp mill wastes reduce DO in Savannah River estuary to zero during late summer; eliminated fish life, benthos; pathogens may also be introduced- hepatitis outbreaks were reported in 1962-1967, high coliform counts.

195. Wastler 1967: Louisiana: 3000 acres of oyster beds were closed to shellfishing due to pathogenic bacterial/viral contamination.

196. Wastler 1967: Sewage runoff and phosphate mine drainage produced extensive algal bloom-benthic macroalgae- in Florida bay- massive bloom of algae Gracilaria resulted in lowered DO.

197. Wastler 1967: Sewage and industrial wastes have high BOD/COD; sludge deposits in Charleston Harbor, S. C. had BOD of 5 mg/1 (sewage and pulp mill wastes).

198. Cronin et al. 1975: Chesapeake-Delaware canal widening had following hydrographic effects: changes in direction, volume, flow, current velocity; increases and decreases in salinity; increased sediment in water column caused by increased flow.

199. Cronin et al. 1975: Enlargement of Chesapeake-Delaware canal had following effects: Delaware River water quality improved; upper Chesapeake salinity higher in summer; benthic/pelagic canal populations shift to east; possible mass transport of striped bass eggs and larvae to lower water quality Delaware River.

200. Dovel 1971: Chesapeake to Delaware canal created a major spawning area for striped bass.

201. Cronin et al. 1975: Biological effects of Chesapeake-Delaware Canal 1) Canal is productive as a nursery/spawning ground for fish - striped bass in particular but several other species too. 2) Dense healthy benthic populations - previously dredged canal repopulated.

202. Windom 1975: Measurement of the amount of ammonia released from dredge spoil should be adequate basis for determination of water quality effects on plant production and DO levels.

203. Pritchard and Cronin 1971: Enlargement of Chesapeake-Delaware canal increased water-transport to Delaware, increased current velocities, tidal exchange, salinities.

204. Windom 1975: Decrease in O_2 due to dredging related to increased BOD caused in part by excess plant production.

205. Brown and Clark 1968: Decreased DO during dredging and filling.

206. Briggs, 1968: N and P increased 50-100 times ambient levels in immediate area of spoil disposal in Chesapeake Bay.

207. Windom 1975: In usual case increased suspended solids caused by dredging in estuaries is temporary.

208. Briggs 1967: Following cessation of dredging, suspended solids decreased to "background levels" in few hours, even in area that was repeatedly dredged over long periods.

209. Wilson 1950: If high levels of suspended sediments are maintained over long periods oysters are harmed.

210. May 1973: Mobile Bay dredging elevated turbidity only a few hundred feet away from dredge.

211. Windom 1975: Initial result of resuspension of dredged material is reduction of heavy metals in water-later increase due to release from sediments.

212. Windom 1975: Dredging-filling increases ammonia from sediments which increases phytoplankton production. This followed by increases in pH, dissolved oxygen and BOD.

213. Davis 1960; Mortality of clam and oyster eggs and larvae significantly reduced at low suspended sediment levels- 124 mg/l.

214. Sherk et al. 1975: Because the major influence of the standing stock of fish populations is in number of juveniles which are produced, mortalities less than 50% caused by man-made causes, when added to natural causes of mortality, might negatively effect fish populations. Thus, LC50 values may not be good estimate of real effects of man induced effects.

Levels of suspended solids which are able to cause 10-50% mortality in estuarine fish can be produced by dredging or excess runoff periods. LC10 may be more realistic.

215. Moser et al. 1972: DDT and PCB altered species composition of mixed cultures of algae in lab experiments.

216. Reimold 1974: Long term study correlated reduction in toxaphene residues in estuary was accompanied by increased nekton diversity.

217. Macek 1968: Trout reproduction affected by DDT without reducing size of spawning population (i.e., direct interference with reproduction physiology occurred).

218. Reinert and Bergman 1974: DDT residues accumulate in fish eggs-caused mortality at yolk adsorption stage due to effective concentration of DDT as yolk is consumed.

219. Kjerfue 1976: S. Carolina: Diversion of Santer River into Cooper River had following effects: 1) Lowered salinity at mouth of Santee. 2) Greatly increased flow of Cooper, reduced flow in Santee, causing great increase in sedimentation in Charleston harbor due to changes in mixing. 3) Changes in sediment composition towards fine (now costs $5 million/yr. to dredge harbor). 4) Increased flushing of harbor improved water quality. 5) Erosion in Santee delta due to reduced sedimentation. 6) Increased oyster/clam fisheries in Santee. 7) Increase in Cordgrass in Santee. 8) Provided flood protection.

220. US Department of Interior 1968: Increase in aquifer recharge, increased groundwater discharge, increase groundwater salinity all can be caused by dredging.

221. Pearce 1975: Dredging and filling in inlets with unconsolidated sediments could result in resuspension of polluted pathogenic containing sediments.

222. Inman and Bush 1973: Offshore dredging for gravel resulted in severe erosion of beach in England following removal of 0.5 million metric tons of material.

223. Darnell 1976: Effects of dredging and spoil placement; effects of channelization of floodplains and swamps: drainage of surface water; lowering of water table; elimination of flooding and natural fertilization of floodplain; reduced groundwater recharge; increased erosion; changes in flow regime; increased salinity.

224. Ward 1964: Benthos diversity below a dam in Colorado was less than in control stream but biomass was higher (tolerant species increased).

225. Trotzky and Gregory 1974: Dams used to generate electrical power have more rapid short term changes in stream flow; damaging to benthos; reduced diversity results.

226. Harvey 1975: Gas bubble disease is a danger to fish in water below dams; supersaturated bubbles of nitrogen may be adsorbed into gills of fish and cause diver's disease known as the bends; as little as 18% supersaturation may do this; fish die as result.

227. Baxter 1977: Dams can restrict downstream migration of catadromous species of fish.

228. Aleem 1972: Reducing flow by dam upsets balance between sea erosion and river sediment deposition; increased erosion, reduced sedimentation at delta result.

229. George 1972: Sardine catches in Nile delta decreased due to reduced flow of the Nile river caused by Aswan Dam.

230. Beadle 1974: Changes in flow pattern of river by dam changed spawning grounds of molluscs up and down river by several km.

231. Darnell 1976: Upper level release from reservoir increases temperature in receiving stream; lower level release decreases temperature.

232. Lehmkuhl 1972: Reduced benthos abundance and diversity below dam for 70 miles due to thermal alteration.

233. Lackey et al. 1959: Aquatic animals reduced in abundance by predation, loss of habitat and food when aquatic vegetation is removed, as in a dam or as result of channelization.

234. Fraser 1972:Most freshwater animals show a depth preference during at least one life stage. Changes in water level which reduce aquatic vegetation thus affect these animals- here the effect is on spawning, nursery, habitat, food function of aquatic vegetation;for dams where water levels change rapidly this reduced abundance of aquatic organisms (benthos, fish).

235. Hall et al. 1946: Changes in water levels above dam reduced populations of attached submerged vegetation.

236. Darnell 1976: Increased nutrient runoff due to large amount of decaying trees in flooded impoundments etc. ..., soil nutrients removed, eutrophication plus aquatic vegetation develops-algae and vascular plants.

237. Barstow 1970: Estimated fisheries losses in freshwater habitats during Tennessee drainage project-losses estimated: 95% reduction in fisheries, 86% reduction in waterfowl.

238. Roebeck et al. 1954: Elimination of shallow water areas in dams/impoundments due to water level changes is highly damaging to biological community of Roosevelt Lake. Columbia River. Drawdown decreased productivity and fish abundance.

239. Starrett 1951: In Iowa streams, spawning of certain fish requires access to floodplain backwaters; elimination of these areas by dam thus reduces faunal reproductive potential.

240. Dorris and Copeland 1962: Winter drawdown in Mississippi impoundment reduced benthos (mainly larval mayfly) population in receiving stream.

241. Fraser 1972: Summarized information on prevention of upstream migration of fish by dams.

242. Clothier 1953: 90,000 acres irrigated (Gallatian River Montana): in over 2 years more than 5600 lbs of fish (game fish) was lost.

243. Hallock and Van Woert 1959: Young salmon injured and killed as they pass through irrigation pumps.

244. Clotheir 1953 : Fish mortality caused by irrigation diversions in western states.

245. Schoeneman et al. 1961: 4-9% mortality of fish going through dam turbines; a series of dams would give multiple amount of mortality to migrating salmon.

246. Neel 1963: Nutrient enrichment results when riparian areas flooded or hypolimnion of dam released into stream.

247. Darnell 1976: Flooding riparian vegetation leads to nutrient enrichment which produces increased decomposition, lower DO, reduction of stream benthos.

248. Bourn and Cottam 1950: 10 years after channelization still observed reduction in aquatic animal abundance (a 39-97% reduction in abundance was observed in total invertebrate population; mollusks and crustaceans reduced 32-100%).

249. Tarzwell 1937: Rated type of substrate to stream productivity-sand/silt was lowest, vegetated areas highest- sedimentation reduces productivity.

250. Darnell 1976: Sedimentation caused by channelization reduces fish population by reducing food supply, elimination of spawning areas or smothering of eggs and larvae, and elimination of fish habitat.

251. Starret 1971: 25 of original 49 known native mussel species in Illinois river destroyed by siltation from channelization.

252. Ellis 1931: Siltation of Mississippi river eliminated or greatly reduced benthos abundance.

253. Darnell 1976: Riffle animals killed by sedimentation which fills interstitial spaces and lowers O_2.

254. Sumner and Smith 1939: Animal production in silted areas was 50% that in unsilted.

255. Cordone and Pennoyer 1960: Algal pads in river were destroyed by sedimentation caused by channelization primarily a scouring and smothering effect.

256. King and Ball 1964: A doubling of the sedimentation rate caused by highway construction, decreased production of attached algae by 70% (in stream).

257. Tsai1973: Strong negative correlation between constant turbidity and fish species diversity in stream (negative correlation). Channelization increases downstream sedimentation, thus reduces fish diversity.

258. Bourn and Cottam 1950: Aquatic vegetation is sensitive to water level changes caused by drainage/channelization projects.

259. Baldes and Vincent 1969: Many fish select particular current velocity if provided choice; avoid unnaturally high flows, as in channelized streams.

260. Tarplee et al. 1971: Channelization reduced abundance of stream benthos by 79% in North Carolina stream-caused by lack of suitable substrate for attachment.

261. Darnell 1976: Channelization produces increased erosion and sedimentation downstream and increases flood hazard as consequence.

262. Congdon 1971: Channelization reduced fish population by 86% in Missouri stream.

263. Tarplee et al. 1971: 32% reduction in abundance of all fish species in channelized North Carolina streams.

264. Bayless and Smith 1967: Channelization reduced game fish by 90% in streams in North Carolina; only limited recovery occurred 40 years later.

265. Darnell 1976: Channelization removes aquatic vegetation. Beds of aquatic vegetation prevent erosion. Destroy them and scouring and erosion increase, sedimentation increased downstream.

266. Baxter 1975: Prevention of flooding by dams means that floodplain must be fertilized artificially; nutrients will be reduced otherwise.

267. Huet 1965: Changes in sediment particle size and grain size composition of a spawning bed causes by erosion or deposition during dredging or channelization could interfere with demersal fish reproduction.

268. Richie 1970: Spawning bed damage is important factor in considering effects of dredging on demersal egg layers.

269. Gangmark and Bakkale 1960: Gravel bed siltation eliminated good salmon spawning grounds- killed eggs by reducing interstitial water oxygen in channelized stream.

270. Hansen 1971: Effects of channelization include: increased stream temperature due to removal of vegetation along stream beds; increased turbidities.

271. Cordone and Kezley 1961: Sedimentation in streams caused disruption of fish reproduction- sediment covers spawning grounds and smothers eggs.

272. Emerson 1971: Channelization increased bank erosion due to destruction of vegetation.

273. Campbell 1972: Channelization increases flooding downstream.

274. Margalef 1968: Decreased diversity of channelized stream biota due to creation of less diverse environment.

275. Karr and Gorman 1975: Channelization of stream reduces biotic diversity.

276. Gorman and Karr 1977: Channelization reduces stream benthic faunal diversity.

277. Berg 1973: Evidence for transmission of viruses via potable/ recreational water where sewage treatment broke down or contaminated shellfish were eaten.

278. Ranwell 1964: Accumulation of sediment in some cases increases production and abundance of marsh embayment vegetation.

279. Koh and Chang 1973: Ecological effects of dumping of dredge spoil in open ocean: temporary reduction in fish abundance; reduced DO; increased turbidity; increased pesticide levels; increased nutrients in water; build up of solids on the bottom.

280. Hood et al. 1958: Chlorinated hydrocarbons disposed in ocean by Shell Oil "killed or impaired" organisms coming into contact with material, area returned to normal after 3-8 hours; dispersal was slow; possible contamination of commercial fishing grounds; recommended deeper disposal.

281. Bureau of Solid Waste Management 1970. Pesticide containers are an important part of the solid waste problem; they contribute a significant amount of pesticides to the marine environment.

282. USEPA 1974: June 10 1967, a dike holding alkaline fly ash waste for an electric generating plant broke, released 400 acre-ft. (493,000 m^3) of sludge into Clinch River. Killed 216,000 fish and all the benthos for 4 miles downstream.

283. US Department of Interior 1975: Decrease in water quality due to bridge construction due to bridge construction/piers: reduced circulation and lowered DO, associated effects.

284. Clark 1977: Solid fill used to support a road across water can cause flooding on the high side, drought on lower side; block tidal exchange; reduce circulation; destroy marshes by production of reflected waves; reduce production of marshes; change salinity patterns needed for reproduction of estuarine fish/shellfish; buildup of pollutants in shellfish beds; buildup of sediments behind road; buildup of water killed nesting ground birds; associated dredge and fill effects.

289. Clark 1977: Breakwaters, jetties etc. ... as solid fill can have following effects on coastal ecosystems: reduce circulation/flushing; reduce light penetration; reduce water quality by creating stagnant areas; increase sedimentation, erosion and scouring; increase runoff from surfaced areas; increase downstream flooding; increase nutrients in water column; disrupt long shore drift; reduce beach habitat; smother benthos; stimulate eutrophic conditions; reduce DO by fouling communities.

286. Clark 1977: Dumping of sewage in larger bays and sounds carries with it risks of pollution by pathogenic organisms; increase in toxic substances and nutrients.

287. Clark 1977: 5 effects of sewage pollution: hazard to human health due to pathogens; aesthetic offense; reduced DO caused by high BOD; eutrophic conditions caused by elevated nutrients; toxic effects of pesticides, heavy metals and other toxics.

288. Gray 1974: 44,000 acres of shellfish closed because of sewage pollution.

289. US Department of Interior 1968: 2 million acres of commercial shellfish beds in US have been closed due to sewage pollution.

290. Chapman 1966: Showed high correlation between fisheries harvest in estuaries and freshwater input- dry years were lowest, wet years highest- in Texas Coastal estuary.

291. Hoese 1967: Oyster drills enter and attack oysters during high salinity (dry) years in Texas estuary. Hard shell clams and sharks also increased; water diversions which increased salinity therefore caused reduction in fisheries organisms.

292. Teal and Valiela 1973: Spartina marsh is a "living filter" that purifies sewage. The result is increased plant growth reduced N_2 fixation, increased denitrification. A marsh can process twice the sewage sludge, land can.

293. Dunstan et al. 1975: 100 ppm copper, cadmium, lead produced death of marsh grass (Spartina) seedlings after two weeks, 50% mortality after 8 weeks.

294. Mackin 1950: Experiments showed both stimulation and inhibition of salt marsh grass (Spartina) by oil. Repeated applications were lethal.

295. Baker 1970: More than 2 or 3 weeks of "new oil" spills/year or 1 or 2 light oilings/year of weathered oil will probably reduce abundance and production of Spartina marsh grass.

296. Baker 1971: Oil stimulated growth of Spartina related to greater water retention ability of sediment, release of nutrients from killed animals, nutrients in oil, or N_2 fixing by oil degradation bacteria.

297. Mock 1966: 2.5 times brown shrimp and 14 times more white shrimp harvested from natural part of Texas estuary then from bulkheaded part.

298. Colonell 1977: Walkways, piers, docks, towers, breakwaters etc. all have potential for: increasing and decreasing sand supply to beaches; altering shoreline where sand transported with littoral drift; changing wave energy that impinges on shoreline-wave shadows can reduce longshore drift-buildup of beach behind offshore breakwater is an example.

299. McKnulty 1977: Effects of sewage pollution: particulate material exerts high BOD, adsorbs heavy metals and pesticides; reduces light penetration; stimulates phytoplankton/zooplankton growth by providing nutrients (but also producing a BOD load simultaneously); increases in fish kills due to increased BOD loads; lethal effects of heavy metals, phenols and arsenic depress growth of aquatic flora and fauna, especially larval stages (reproductive interference).

300. Odum 1974: Changes in tidal amplitude and flushing rate will reduce emergent plant production in estuary since production is greater at high flushing rates and greater tidal amplitudes.

301. Adams 1963: Changes which increase salinity such as water diversion, over Spartina marsh will decrease productivity.

302. Phleger 1971: 4% reduction in growth of Spartina for every 8% increase in salinity (for S. foliosa); Channelization and/or water diversion cause salinity to change.

303. Braarud and Hope 1952: Addition of sewage high in N and P increased phytoplankton abundance and production.

304. Coutant and Goodyear 1972: Shifts in diversity and productivity (both increases and decreases) of marine phytoplankton due to thermal pollution.

305. Cairns 1971: Changes (both increases and decreases) in biomass and productivity of marine phytoplankton due to thermal effluent.

306. Beeton 1969: Eutrophication of Lake Erie related to increased nutrient and organic loading: result is increased dissolved solids; increased primary production, algal abundance; increased nutrients; increased BOD; decreased DO in hypolimnion; increases and decreases in animals.

307. Barlow et al. 1963: Because of man induced fertilization of estuary, the following resulted: rapid drop in DO diurnally; increased sedimentation; high rates of primary production; increased algal abundance; increased BOD.

308. Ryther and Dunstan 1971: Large blooms of algae caused by nutrient inputs from duck farms in New York and other sources. Nitrogen is usually the limiting factor in coastal estuarine waters since surplus P is present. Removal of P from detergents will not therefore necessarily eliminate algal blooms. Replacement of P with NTA in detergents may add more N and aggrevate the problem.

309. Gates 1959: Showed elevated pathogenic bacteria in wastewater from duck farm in New York.

310. Metcalf and Stiles 1965 and 1968: Infectious hepatitis shown to be clearly caused by infected shellfish; raw sewage contained entero-viruses and bacteria.

311. Bidwell and Kelly 1950: Elevated pathogenic bacteria in duck farm wastes; oysters were contaminated with pathogens.

312. Waldichuk 1977: Effects of settleable organic wastes on marine life: reduced DO as bacteria decompose material, increased H_2S production (methane too), possible pathogens; suspended wood particles can cause abrasion in fish gills; fish mortality.

313. Woodwell 1970: Simplification of ecosystems occurs when they are insecticided.

314. Darnell 1976: Effects of air pollutants on water: "such pollutants may eventually enter the water courses".

315. Darnell 1976: Line construction (including culverting) can have the following effects: lowered water table; increased erosion; large changes in streamflow; increased downstream flooding; increased sedimentation; increased suspended sediments; increased turbidity.

316. Waldichuk 1960: Oxygen demand of kraft mill effluents can be a barrier to migrating Salmon.

317. Darnell 1976: Bridge construction can cause erosion, increased suspended solids, increased sedimentation, removal of vegetation; later, contamination of water with heavy metals, asbestos and hydrocarbons.

318. Beaven et al. 1962: 2, 4-D used in Chesapeake Bay to control milfoil had no effects on oysters, crabs, clams and fish; but did kill these organisms due to DO drop caused by rotting vegetation.

319. Clark 1977: Poorly designed bridges reduce water exchange and flushing of wetlands; example Great South Bay Bridge in Long Island, produces reduced circulation/exchange; reduced water quality (DO, etc.).

320. Clark 1977: Piers and docks may have dredging related effects associated with them, but these are temporary in usual case.

321. Conservation Foundation 1974: Artificial reefs develop high current velocities around themselves usually and increases in both plant and animal abundance and diversity.

322. Carlisle et al. 1964: Streetcar, car body, oil platform reefs in California attracted fish (Bass). Increases in algae, barnacle and mussel abundance were observed.

323. Turner et al. 1966: Increased benthic animal abundance associated with physical presence of sewer outfall pipe.

324. Lawrence 1962: Copper sulfate is toxic to fish and benthic invertebrates at low levels.

325. Vernon 1954: Copper sulfate precipitates on fish gills and can cause suffocation.

326. Brian 1964: Copper sulfate inactivates plant enzymes and causes the precipitation of proteins.

327. Hughes and Davis 1963: 2, 4-D is toxic to fish and benthic invertebrates.

328. Petruk 1965: 2, 4-D added to water produces large increases in bacterial populations.

329. Mulligan 1969: Reduced DO produced when plants in water are herbicided; also increased nutrients in water result from decomposing plant material; massive algal blooms usually result; fish may suffocate due to large DO changes; chemical treatment only temporary solution.

330. Merril et al. 1977: Cu, Hg, Ag, Zn and Fe, some plastics, detergents are toxic to larval shellfish. Pesticide levels in shellfish may be affecting their longevity, growth and disease resistance.

331. Walburg and Nichols 1967: Decline in American Shad related to elimination of available spawning areas in rivers caused by dams on coastal streams.

332. Copeland 1966 : More dams on coastal rivers has decreased freshwater input to estuaries, delivery of nutrients to coastal estuaries.

333. Smith 1966: Flow in coastal rivers augmented to reduce spring and autumn flood periods required for spawning by migrating fish.

334. Smith 1966: Dredging of Mississippi River to produce Gulf outlet in Louisiana changed current and exchange, increased salinity of Lake Ponchartrain.

335. Lowe 1965: Blue crabs were sterilized when subjected to sublethal DDT concentrations.

336. Darnell 1976: Effects of stream channelization: deepen channel; lower water table; increase flow rate; increase channel/bank erosion; reduce stream habitat diversity; increase downstream sedimentation; increase downstream flood hazard.

337. Odum, W. E. 1969: Fine organic sediments/detritus accumulate 100,000 times the concentration of pesticides as found in water.

338. Burke 1977: Urban runoff contains significant amounts of suspended solids, high BOD, nutrients, chlorides, oil and grease, heavy metals (10-100 times that in sewage), pesticides and other toxins.

339. Woodwell et al. 1967: Total DDT levels in estuary sediments could be as high as 14.7 kg/hectare (east coast estuary).

340. Odum et al. 1969: Detritus in estuaries strongly absorbs DDT, may contain 50 ppm DDT.

341. Hugget et al. 1971: Mercury in estuaries becomes associated with bottom sediments.

342. Gorbman and James 1958: Thyroid damage in fish at atom bomb test sites in Pacific due to accumulation of ^{131}I through food chain.

343. Hill and Hely 1973: Cooling water of coal fired power plant reacted with sediments causing release of heavy metals into water.

344. Wolfe 1974: Four possible effects of radioactive materials in estuaries: 1. "somatic damage (including death) of estuarine biota". 2. "increase in genetic mutation rates of populations" 3. "increase in growth rate and maximum size of population" 4. "reorientation of human uses of estuaries".

345. Becker and Thatcher 1973: Toxicants produced by nuclear power plants and/or cooling towers include: acids, acrolein; arsenic; ammonia; quinines; boron; carbonates; chlorines; bromine; chlorinated and/or phenylated compounds; chromates; cyanurates; cyanides; hydrazines; metals (and their salts); sulfides; flourides.

346. Nuzzi 1972: Levels of mercury currently in ocean may damage marine phytoplankton, reduce diversity, production.

347. Weiss and Wilkes 1974: Sewage adds N and P to estuary; causes algal blooms; DO drops; increased pathogens.

348. Rabin and Schwartz 1972: Sewage sludge contained 600-2500 ppm Zn and Cu.

349. Rabin and Schwartz 1972: Heavy metal levels toxic to marine life (water level) generally range between 0.01-10 ppm.

350. Feibusch 1975: Main impact of solid waste disposal on estuary is from leachate from landfills (legal and illegal): pollution resulting from fills includes: pesticides, heavy metals, BOD/COD materials; also reduces size of estuary or marsh.

351. Clark 1977: Solid waste landfills can produce water pollution in estuaries by leaching of toxics, nutrients, and dissolved organics.

352. Schelske 1972: Scallops contained 30 times more ^{54}Mn then other molluscs. Maximum concentrations were 100 pCi/g wet weight; accumulated through food chain and by direct adsorption and filtering.

353. Hughes and Cartwright 1972: Leachate from landfills contain high levels of BOD/COD, heavy metals, and dissolved solids.

354. Wolfe 1970: Oysters accumulated ^{65}Zn from fallout; values ranged from 2-20 pCi ^{65}Zn per 100 g wet weight.

355. Wolfe 1971: Accumulation in clams of radioactive ^{137}Ce due to fallout varied seasonally, directly related to temperature, inversely to salinity.

356. Wolfe 1974: Gives summary of radionuclides emitted by nuclear power plants to atmosphere and water includes heavy metals ^{64}Cu, ^{56}Mn, ^{51}Cr, ^{69}Zn, ^{65}Zn. Also fallout due to nuclear weapons adds others.

357. Gross 1970: Ocean dumps (solid wastes) are usually characterized by high levels of heavy metals, petrochemicals, PCB's, pesticides other wastes. Organics have high BOD, and pathogens usually.

358. Schelske 1971: Fish, clams, mussels, scallops, and oysters all accumulated fallout in measurable levels. Clams, mussels and oysters accumulated primarily large amounts of ^{144}Ce and ^{106}Ru; Fish ^{137}Cs, ^{54}Mn.

359. Schneider 1970: Poorly designed sanitary landfills can pollute coastal waters through groundwater, streams, rivers. Following pollutants: toxics (PCB's pesticides, heavy metals) and nutrients; landfills are a major source of these materials in coastal areas.

360. Zieman 1976: Turtle grass does not recover rapidly from motor boat cuts because of slow rhizome growth. Tracks require 2-5 years to regrow; decrease in pH, Eh, poor for growth of grass.

361. National Academy of Science 1971 : Sewage introduces pathogens into coastal waters: poliovirus, Coxsackie virus, Echovirus, Rheovirus, Adrenovirus and Hepatitis virus.

362. Copeland and Jones 1956: Sewage disposal into hypersaline lagoon caused DO to drop to zero. Organics settled and killed benthos, including animals/plants. Productivity and diversity dropped to "almost" zero.

363. Ketchum 1972: Sources of radioactive waste in the marine environment: Collisions of nuclear ships, submarines, accidental dropping of weapons from military aircraft, crashing of aircraft.

364. Ketchum 1972: Nuclear fuel reprocessing plants will have (perhaps) largest releases of radioactivity in future - especially have to watch ^{151}I, ^{90}Sr, ^{137}Ce, Tritium, ^{39}Ar, Krypton 88. Plutonium storage is worst problem - half life requires 10^5 years storage to decay.

365. Ketchum 1972: Lists radioactive wastes from a nuclear power plant - Mn, Cl, Sr, Y, Mo.

366. Pearch 1970: Some solid waste dumps are inhabited by marine organisms, others are devoid of life.

367. Ketchum 1972: Liquid waste from households include: suspended solids, dissolved solids, BOD/COD producing substances, detergents, Nitrogen, Phosphorus, grease and oils.

368. Ketchum 1972: Projected % increases in several metals in ocean via atmospheric fallout of particulates.

369. National Academy of Sciences 1971 : Atmospheric lead contributes 3 times more lead to ocean then does runoff.

370. Patterson 1971: Lead transported in atmosphere concentrates in upper levels of the ocean (Pacific in this example)- there is 10 times the amount of lead in upper waters as compared with the lower depths; major transport vector was aerosols from auto exhausts and lead processing industries.

371. Gunter 1957: Flood control levees along Mississippi River produce faster runoff, greater transport velocities, increases in sedimentation, prevention of flooding of marshes, flood-plains and estuaries; increases in erosion, huge silt deposition in Gulf of Mexico; reduced nutrient drainage from land; salinity increases, less change in salinity, erosion of islands increased; some oyster reefs eliminated.

372. Gunter 1953; Diversion of Mississippi River flow through Bonnet-Carre spillway to lake Pontchartrain between 1937-1950, motile organisms driven out of lake, benthic animals killed; large increase in nutrients added to the lake; when salinities were again normal shrimp populations increased.

373. Cronin 1967: Water diversion may reduce fish reproductive potential by eliminating home stream water which is sensed by migrating fish.

374. Cronin et al. 1971: Jetties produce minimal biological effects; flora and fauna are actually increased in abundance and diversity over existing beach; however, jetties may block littoral drift and interfere with beach ecosystem; also may block migration of animals into and out of estuary.

375. Wilhm and Dorris 1968: Reduced benthic faunal diversity in stream receiving oil refinery effluents.

376. Tsai 1968: Reduced fish diversity below Patuxent River (Maryland) sewage outfall.

377. Copeland and Jones 1965: Natural impoundment of hypersaline lagoon-Laguna Madre in Texas: lowered productivity due to increased salinity caused by increased evaporation.

378. Price 1968: Effects of impounding a 35,000 acre mudflat on west side of Laguna Madre: 1. Reduced (eliminated) tidal flushing across mudflat. 2. Salts evaporated as a result, wind carried them landward, killed off several thousand acres of pasture land. 3. Destroyed bluegreen algae mat that had been in mudflat.

379. Clark and Terrell 1978: Landfilling of solid wastes on the shore particularly in wetland areas, potentially causes: 1. Contamination of groundwater with leachates. 2. Reduction in area of wetlands.

380. Clark and Terrell 1978: Diking of coastal marshes seriously disturbs the water level by: 1. Prevention of freshwater flooding and fertilization. 2. Prevention of annual flushing. 3. Prevention of annual renewal of sediments and nutrients. 4. Prevention of the formation of new marshes. Dikes and levees to subsidence of soil, through drying, compaction, and oxidation. Diking of 10,000 acres in southern New Jersey resulted in mosquito infestations requiring the application of pesticides, destroyed habitat for an estimated 20,000 clapper rails in summer and 10,000 black ducks in the winter.

381. Clark and Terrell 1978: Excavation by ditching drains a marsh, converting the low marsh to a high marsh or upland community. Result is a loss of diversity of animals, with disappearance of crustacea and molluscs.

382. Schmid 1977: Irrigation and artificial fertilization have permitted a host of introduced ornamental species to survive on Fire Island, both with and without cultivation.

383. Godfrey 1977: Off-road vehicles (ORV) severely damage low salt marsh community (Spartina dominates). Vehicles crush soft peat substrate, creating depressions ("pannes") in which salt water is retained. Mosquitoes breed in the pannes.

384. Woodwell 1967: Chlorinated hydrocarbons, such as DDT, become concentrated in fish, fish-eating birds, and other carnivores. In some birds, especially predatory birds such as hawks and eagles, these chemicals contribute to egg-shell thinning and ultimately to reduced nesting success, thereby causing population declines.

385. Buckley and Buckley 1977: Ditching of salt marshes for mosquito control reduces or drains the pools in which shorebirds and waterfowl abound. Ditching has a pronounced detrimental affect on these birds, reducing the diversity of the birds that nest there by a significant level.

386. Buckley and Buckley 1977: In many beach parks, extensive plantings of native and exotic conifers are made. With these vegetational changes come significant changes in birdlife; land bird diversity increase without a doubt, and often spectacularly so. Songbirds on migration stop and linger where previously there was no habitat. Ornamental plants provide nesting habitat for mourning doves, purple grackles, and house finches; shrublands support great numbers of wintering Myrtle Warblers, woodland owls arrive to winter in sheltered coastal Black Pine groves adjacent to salt marches overrun with voles, mice, and rats.

387. Buckley and Buckley 1977: Beach development has caused the local extirpation of many species of birds. However, recently common and Roseate Terns and Black Skimmers are now nesting on open marshy lands in large numbers. It is not clear whether these species will maintain level population densities in such conditions. (Rats are predators there.)

388. Buckley and Buckley 1977: Filling (unconsolidated) wetlands or near beaches with garbage (trash) has resulted in large gull populations, a hazard at airports and elsewhere. Filling (consol.) - Construction of thousands of groins and jetties down the Atlantic coast has contributed to the southward extension of several rock-loving birds, including purple sandpiper, harlequin duck, common eiders, and king eiders.

389. Buckley and Buckley 1977: Excavation of a 250 foot swath across Great South Bay salt marshes and bottoms was made to construct Nassau County/Wantaugh ocean outfall sewer line. After burial, the right-of-way was covered with fresh, clean fill originally removed during construction. This expanses of sand and mud with intermittent pools of shallow Spartina formed ideal habitat for a rich diversity of marsh birds, including some of the greatest concentrations and mixtures of shorebirds seen on western Long Island in recent years. It also provided breeding habitat for tern and skimmer colonies, including the first known nest in New York of Gull-billed Tern, thereby extending the species' breeding range some 150 miles north of its previous limit.

On the negative side, vast quantities of shellfish and benthic plants and animals were destroyed in the process of cutting the outfall line, as well as the inevitable effect on mainland Long Island's watertable which will result from dumping hundreds of millions of gallons of freshwater into the ocean instead of recharging the fast disappearing aquifers.

390. Buckley and Buckley 1977: Dredge spoil islands are the only locations of relatively undisturbed habitat for many beachfront or true colonial nesting birds, such as Piping Plover, Black Skimmer, Herring and Great Black-backed Gulls, and herons, egrets, and ibises. Located as they invariably are along major "inside" waterways and at inlets, these islands now provide the largest single source of available habitat for colonially nesting waterbirds along the entire coast of Long Island. They are exceptionally important in coastal New Jersey, and in the Outer Banks of North Carolina as well. They may also provide nesting habitat for waterfowl.

391. Buckley and Buckley 1977: Off-road vehicles have an adverse effect on bird wildlife, as on Jamaica Bay Wildlife Refuge.

392. Chattin 1970: In California, black brant are a thing of the past. Since the late 1940's the species has declined from well over 60,000 birds to near zero today. While much speculation attended its steady decline, the best guess is that human activity, harassment and disturbance was the cause of it. Of course management shortcomings are capable of remedy and black brant could probably be reinstated as residents of California if, in fact, the causes mentioned are the real ones leading to abandonment of the area.

393. Tillis 1973: The following effects were recorded for a large bayfill operation in Alfia Sanctuary on Green Key: nesting by American egrets dropped from 18-28 pairs to zero. Brown pelicans, which normally nested until fall, hatched one batch of young then deserted the island, nesting cormorants declined by 50 percent and the numbers of wood ibis that nested there dropped from 25-30 to 2 or 3. Although a dozen yellow crowned night herons normally nested in the area, none did so following the nearby filling operation.

394. Ferrigno et al. 1964: From 1955-1968, 16.2% or 34.703 acres of coastal wetlands were filled or diked in Ocean, Atlantic, Burlington, Cape May, Cumberland, and Salem counties in New Jersey. Filling and diking have lead to decline in *Spartina alterniflora*, and *Spartina patens* and promoted the spread of common reed, *Phragmites communis*.

395. Ferrigno et al. 1969: Insecticides (DDT, DDE, DDD) recorded at 4.5 ppm on salt marsh vegetation. Values given for several wildlife sp., to 17.4 ppm in black duck eggs and as high as 40.1 ppm in dead herons.

396. Clark 1974: Diking (1) prevents passage of fish to marsh and (2) obstructs continuity (flow) of nutrients to the estuary (3) produces mosquito breeding grounds and encourages spraying with pesticides.

397. Clark 1974: Sewage treatment facilities increase flow of nutrients into coastal zone systems.

398. Clark 1974: Clearing removes habitat and fauna from site (construction sites).

399. Clark 1974: Drainage (urban runoff) - stormwater from cities flushes the surface and there is little or no chance for purification prior to flow into coastal zone ecosystem.

400. Mangold 1962: Diking and absence of tide flows enhances Spartina alterniflora but kills S. patens, Iva frutescens (marsh elder), and Baciliaris halimifolia (high tide bush).

401. Ferrigno 1961: Diking of salt hay marshes in New Jersey "can be a potential mosquito breeding hazard" (mosquito is Aedes sollicitans, a potential vector of disease.)

402. Bourn and Cottam 1950: Excavating (ditching) during the 1930's led to many vegetation changes, which were documented in type-maps of the Mispillion marshes made on 1936, 1938, 1939, 1946, and 1946.

403. Daiber et al. 1976: Ditching may lower the water table.

404. Daiber et al. 1976: Inundation may increase brackish and fresh-water plant species.

405. Daiber et al. 1976: Bulkheading and consolidated filling curtails nutrient exchange, prevents physical and biological interactions between tidewater and terrestrial biota.

406. Daiber et al. 1972: Excavating channels increases saltwater intrusion, alters tidal exchange, alters mixing cycles, and is a source of potential pollution of freshwater aquifers.

407. Copeland and Dickens 1974: Excavation of channels increases salt-water intrusion alters mixing cycles and is a source of potential pollution of freshwater aquifers.

408. Godfrey et al. 1978: Vehicle impacts severe, and can stop the seaward growth of American beach grass (Ammophila breviligulata) in fewer than 100 passes on an established dune.

409. Godfrey et al. 1978: Pedestrian traffic destroys bird nesting habitat and upsets reproductive schedules.

410. Krutson 1978: Clearing and foresting has changed many dunes dramatically, reducing or eliminating the natural vegetation and other organisms living there.

411. Faust and Goff 1978: Organic pollution from urban and rural sources increased the levels of fecal coliform bacteria and fecal streptococci in a subestuary of the Chesapeake Bay.

412. Houge et al. 1978: Clearing of forests (61 in coastal zone of CA) was followed by study of soil erosion plots. Gully erosion increased by 50% on cut blocks, and the amount of vegetation on the same plots increased by 100%.

413. Inman 1978: Construction of structures has often led to increased erosion.

414. Inman 1978: Excavating dunes (for sand/gravel) has had adverse effects on shorelines.

415. Klump and Smith 1976: Vehicle traffic (1-2 passes/wk) or pedestrian traffic (10-15/wk) along the same route through beach grass (Ammophila) will kill it.

416. McHarg 1969: On barrier islands, subsurface water demand may lower the water table below a critical point and could result in saltwater intrusion, and ultimately to killing off of the stabilizing vegetation.

417. Hauley 1973: Land clearing and drainage frequently add to both the volume of freshwater and the sediment load sent downstream.

418. Rulison and Martin 1972: Channelization; destroys habitat for aquatic life, raises turbidity and temperature of water uplands, reduces the period in which water stands in the forest, changes composition of forest from germ & cypress to red maple, green ash, and such conifers as loblolly and slush pine. The former species require standing water for reproduction.

419. Koeman and Van Gendesen 1966: Pesticides (high levels) in tissues of coastal birds related to mortality (Spoonbills, oystercatchers, terns, gulls, and ducks).

420. Ames 1966: Pesticide loads had adverse effect on nesting success in ospreys.

421. Mooring 1970: Seeds of Spartina alterniflora germinate with greater frequency in alternating thermoperiod (65-95) than in constant 72° temperatures. [thermal effluents may enhance germination of seeds, and within limits, almost surely do not inhibit germination.]

422. Woodwell et al. 1967: Pesticides in a Long Island Spartina poterus marsh showed affects at higher trophic levels with increased concentrations. Major effects seen first in the organisms highest in the food chains.

423. Springer 1961: Pesticides (DDT, Aldrin, Dieldrin, and BHC) affected the animals living in the marsh systems on the US eastern seaboard, in the following manners. 1) Athropods most seriously affected, particularly prawns and blue crabs. 2) Fish in marsh creeks suffered mortality in proportion to doses. 3) Molluscs, snails, turtles, frogs, and mammals showed little evident harm.

424. Chapman 1967: Unconsolidated non-hazardous (or fill, consolidated or unconsolidated) dredge spoil in the estuarine environment can best be assessed in terms of direct physical loss of habitat. [decrease in abundance and diversity of flora and fauna].

425. Davis and Gray 1966: 1) Ditching (drainage) lowered both water table and duration of flooding, resulting in a shift toward species more characteristic of drier situations at the edge of the marsh. 2) Ditching, which led to changes above in (1), resulted in habitat and biota more like those of high marsh border systems, i.e., characterized by smaller numbers of animals. 3) Ditching, which led to changes in (1), retards or eliminates the export of organic matter to estuarine waters. Thus, the effect of ditching is probably detrimental on both the marsh proper and the estuary.

426. Rollins 1973: Salt changes soil salinity and consequently the vegetation of an area.

427. Shieve 1910: Inundation by freshwater leads to replacement of <u>Spartina</u> sp. by <u>Scirpus</u> and <u>Typha</u>.

428. Hobie and Likens 1973: Clearing of forest lands lead to a 26% in surface runoff shortly thereafter.

429. Hoover 1952: Clearing may double flood peaks.

430. Borman et al. 1968: Clear-cut lands had cation-losses 3 to 20 times greater than the vegetated control plots.

431. Bayly and Williams 1973: Clearing of land may so alter the hydrologic regime to cause streams to become intermittent.

432. Darnell 1976: Channelization caused a drop in the water table of the surrounding lands; leads to erosion through steeper gradients and faster flow rate; increased flow tends to reduce habitat diversity.

433. Hoover 1944: Clearing (in North Carolina) was followed by increased water loss.

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